APPENDIX N

BASELINE EVALUATION OF SELECTED ANALYTES DETECTED IN SOIL AND GROUNDWATER

APPENDIX N-1

EVALUATION OF SITE BASELINE CONCENTRATIONS FOR CHLORINATED VOCs, PAHs, and SELECTED INORGANICS IN UNSATURATED ZONE SOILS STRATFORD ARMY ENGINE PLANT

This appendix presents an evaluation of baseline conditions with respect to the concentrations of chlorinated volatile organic compounds (cVOCs), polynuclear aromatic hydrocarbons (PAHs), and selected inorganic analytes detected in unsaturated zone soils at the Stratford Army Engine Plant Site. This analysis includes a review of detected concentrations of the analytes within these three analyte classes in Site soil samples for the purpose of establishing a baseline value, or range of concentrations, of these analytes to be used in the determination of potential releases of contaminants from Areas of Concern (AOCs). Detailed discussions of the sample observations and proposed baseline concentrations for release determinations are provided in the following paragraphs.

Section N-1.1 provides a summary of the data set used to evaluate baseline conditions. Section N-1.2 provides an overview of the methodology used to evaluate the Site soil data. The evaluations of the Site surface soil baseline concentrations for cVOCs, PAHs, selected inorganics, and TPH are provided in Section N-1.3, N-1.4, N-1.5, and N-1.6, respectively.

N-1.1 Soil Samples Included in the Baseline Evaluation

The Site lacks a typical "background" soil data set representative of soils un-impacted by site activities; therefore, the existing site-wide soil data have been used for this evaluation. Soil samples from the unsaturated zone (typically less than 11 feet bgs) were selected for evaluation; no distinction was made between soil samples collected from fill material and "natural" soils. Specific soil samples which were eliminated from the data set include:

- Causeway soils, as remediation has been completed for this area; and
- Pilot-scale and bench-scale testing soil samples in the former Chromium Plating Facility vicinity, as the majority of these samples were collected below the water table.

The soil data set was obtained primarily from fill soils, though native soils may exist beneath the southwestern portions of the Site, including portions of Building B-2. Fill, material consisting of sand, gravel, and debris associated with buildings, roads, utilities, site grading, and other structures, is found as the uppermost soil type throughout most of SAEP. The fill is generally about 2 to 5 feet thick, but reaches a thickness of about 20 ft adjacent to the Dike.

It is important to note that many of the Site soil samples were obtained from soils in areas of former industrial activity and some from areas of identified contaminant releases. The soil data set includes some relatively undisturbed native soils, as well as re-worked (disturbed) native soils, fill soils, and soil impacted by release of contaminants. A large number of these samples would qualify as local background samples for the Site.

N-1.2 Methodology for Evaluation of Site Soil

The evaluation of the Site surface soil baseline concentrations for cVOCs, PAHs, and selected inorganics included the following steps:

- The Geographic Information System (GIS) database was queried for detected analytes for each analyte class - cVOCs, PAHs, and selected inorganics.
- Concentration distribution plots were created for the individual analytes within each analyte class. Analyte concentrations were rank ordered and plotted on graphs to identify patterns in analyte

concentration distributions in the Site data set. The analytical data were ranked from lowest to highest concentration for the purposes of plotting in each of these figures.

- The concentration distribution plots were reviewed to qualitatively identify the deflection points (i.e., the concentration at which the distribution begins to increase substantially). The deflection point is defined as an obvious increase in the slope of the plot that may be used to distinguish between a subset of the data that may be normally-distributed and consistent with baseline concentrations, and sampling locations that may have been influenced by historical practices at the Site.
- For inorganics, the estimated arithmetic mean concentration for eastern United States soils (Shacklette and Boerngen, 1984) and the CTDEP Residential and Industrial/Commercial Direct Exposure Criteria were also plotted on the concentration distribution plots for comparison.
- The maximum concentrations of analytes for cVOCs and PAHs were plotted on a site map to evaluate concentrations relative to known historical practices and contaminant releases at AOCs.

The following subsections present an assessment of Site soil concentrations by analyte class with a proposed determination of baseline concentration to be used in identifying potential releases of contaminants from AOCs.

N-1.3 Estimation of Baseline for cVOCs in Soil

Chlorinated VOCs were primarily used as solvents in the manufacturing, testing, and cleaning of various aircraft and engine components throughout the history of SAEP. As a result of the quantities and widespread use of cVOCs at the Site, they have been detected in soils across the entire facility at varying concentrations. Figures N-1 through N-10 present the concentration distribution plots for individual cVOC analytes. Figure N-11 presents the distribution of the maximum detected cVOC concentrations across the site.

A review of the concentration distribution plots identified a distinct pattern relevant to the evaluation of cVOC baseline concentrations at the SAEP Site. The ranked concentrations of the ten cVOC analytes exhibit varying degrees of skewness in their distribution, with the highest concentrations often substantially elevated. These patterns are likely indicative of Site-related influence at the sample locations at the high end of the plots. As an example, the distribution of 1,1,1-trichloroethane (1,1,1-TCA) detected in Site sampling locations is presented in Figure N-1. The plotted concentrations above 0.022 mg/kg (or parts per million [ppm]) increase sharply to a maximum of 340 ppm (beyond the vertical scale of the plot). The sampling locations where elevated concentrations (i.e., above the deflection point) were detected are identified in the cVOC plots (Figures N-1 through N-10).

The following table presents the selected deflection points for each of the cVOCs and the CTDEP DEC (see Figures N-1 through N-10):

cVOC	Estimated Deflection Point Concentration (ppm)	CTDEP Residential DEC (ppm)	CTDEP Industrial/ Commercial DEC (ppm)
1,1,1-Trichloroethane (1,1,1-TCA)	0.022	500	1000
1,1,2-Trichloroethane (1,1,2-TCA)	0.037	11	100
1,1,2,2-Tetrachloroethane (1,1,2,2-TCA)	0.59	3.1	29
1,1-Dichloroethane (1,1-DCA)	0.025	500	1000
1,1-Dichloroethene (1,1-DCE)	0.04	1	9.5
Tetrachloroethene (PCE)	0.01	12	110
Trichloroethene (TCE)	0.015	56	520
Cis-1,2-Dichloroethene (cis-1,2-DCE)	0.021	500	1000
Vinyl Chloride	2.3	0.32	3
Chloroform	0.005	100	940

The geometric mean of the deflection point values is 0.04 ppm. The calculated mean incorporates the anomalously high values for 1,1,2,2-TCA and vinyl chloride, which appear somewhat suspect given the limited sample data sets for these two analytes relative to the other cVOCs. The calculated geometric mean of the deflection point values excluding the 1,1,2,2-TCA and vinyl chloride values is 0.02 ppm.

Figure N-11 presents the distribution of the maximum detected cVOC concentrations by horizontal coordinate, irrespective of sample depth. The following observations have been made regarding the distribution of cVOCs in soil:

- cVOCs have been detected in soils across the entire Site at concentrations between 0.001 and 0.05 ppm, including areas where no industrial activity or chemical storage were known to have occurred (e.g., the North, West, and South Parking Lots);
- The distribution of cVOCs with concentrations ranging from 0.05 to 1 ppm is more limited, and suggests that at least some of the detected cVOCs within this range are present as a result of potential releases. However, there are detections within this range in areas where no industrial activity or chemical is known to have occurred; and
- The areas of cVOCs with concentrations greater than 1 ppm correlate well with areas of historical usage of solvents and identified releases.

Based on a review of the concentration distribution plots and site-wide horizontal distribution, the presence of detectable cVOC concentrations in soils across the entire Site provides reasonable justification for determination of a baseline value for these analytes. Due to the widespread historical usage of solvents across the Site, there were likely numerous small quantity releases resulting in soil concentrations of cVOCs in the range of 0.001 to 1 ppm. For purposes of evaluating releases of significant quantities of cVOCs from AOCs, a screening value of 1 ppm is proposed for all individual cVOC analytes.

N-1.4 Estimation of Baseline for PAHs in Soil

PAHs include a large group of semivolatile organic compounds (SVOCs), including anthracene, chrysene, fluoranthene, fluorene, naphthalenes, phenanthrene, pyrene, and the group containing benzo[a]anthracene and similar compounds. PAHs have been detected in soils across the entire facility at varying concentrations. There are several possible sources for the PAHs detected in soils beneath the Site:

- PAHs are present as components of jet fuels and heating oils, and are also generated by incomplete combustion of these fuels. Jet fuels and heating oils were widely used across the site, and documented releases of these fuels have occurred.

- PAHs are typically present in asphalt, which covers large portions of the Site.
- PAHs are also quite common in surface soils in areas of historical industrial activity, such as the southwestern Connecticut coastline where the Site is located.
- Fill materials brought onto the Site or those dredged from the Housatonic River may have contained PAHs.

Figure N-12 presents a concentration distribution plot for PAHs in site soils, and Figures N-13 through N-30 present the concentration distribution plots for individual PAH analytes. Figure N-31 presents the distribution of the maximum detected PAH concentrations across the site.

A review of the concentration distribution plots identifies several distinct patterns relevant to the evaluation of PAH baseline concentrations at the SAEP Site. The ranked concentrations of the PAH analytes exhibit varying degrees of skewness in their distribution, with the highest concentrations often substantially elevated. These patterns are likely indicative of Site-related influence at the sample locations at the high end of the plots. As an example, the distribution of benzo(a)anthracene detected in Site sampling locations is presented in Figure N-18. The plotted concentrations above 0.89 ppm increase sharply to a maximum of 39 ppm. The sampling locations where elevated concentrations (i.e., above the deflection point) were detected are identified in the PAH plots (Figures N-13 through N-30).

The following table presents the selected deflection points for PAHs and the CTDEP DEC (see Figures N-13 through N-30):

PAH	Estimated Deflection Point Concentration (ppm)	CTDEP Residential DEC	CTDEP Industrial/ Commercial DEC
2-Methylnaphthalene	0.16	-	-
9H-Fluorene	0.89	-	-
Acenaphthene	0.83	-	-
Acenaphthylene	0.15	1000	2500
Anthracene	0.2	1000	2500
Benzo[a]anthracene	0.93	1	7.8
Benzo[a]pyrene	1	1	7.8
Benzo[b]fluoranthene	0.97	1	7.8
Benzo[ghi]fluoranthene	0.65	-	-
Benzo[ghi]perylene	0.91	-	-
Benzo[k]fluoranthene	1	8.4	78
Chrysene	1.1	-	-
Dibenz[ah]anthracene	0.82	-	-
Fluoranthene	1.5	1000	2500
Indeno[1,2,3-c,d]pyrene	4.8	-	-
Naphthalene	0.1	1000	2500
Phenanthrene	1.1	1000	2500
Pyrene	1.5	1000	2500

The geometric mean of the PAH deflection point values is 0.7 ppm.

Figure N-31 presents the distribution of the maximum detected PAH concentrations by horizontal coordinate, irrespective of sample depth. The following observations have been made regarding the distribution of PAHs in soil:

- PAHs have been detected in soils across the entire Site at concentrations between 0.001 and 0.5 ppm, including areas where no industrial activity were known to have occurred (e.g., the West and South Parking Lots);
- The distribution of PAHs with concentrations ranging from 0.5 to 1.0 ppm is more limited, and suggests that at least some of the detected PAHs within this range may be present as a result of potential releases. However, there are detections within this range in areas where no industrial activity is known to have occurred (e.g., South Parking Lot and the extreme northern end of the Dike), suggesting that concentrations within this range may also be reflective of PAHs used in fill or leached from existing asphalt surfaces;
- The areas of PAHs with concentrations greater than 1.0 ppm correlate reasonably well with areas of fuel usage and identified releases (e.g., Building B-13 and B-15 area, the area underneath the South Parking Lot filled with soils from B-34 and B-65 excavations, etc.)

Based on a review of the concentration distribution plots and site-wide horizontal distribution, the presence of detectable PAH concentrations in soils across the entire Site provides reasonable justification for determination of a baseline value for these analytes. Comparison of the geometric mean (0.7 ppm) of the estimated deflection points for selected PAH analytes to the observation that PAHs with concentrations greater than 1.0 ppm are potentially attributable to Site activities, suggests that a reasonable threshold or baseline value for PAHs as a group is 1.0 ppm. Therefore, for determination of potential releases of PAHs from AOCs, a screening value of 1.0 ppm is proposed for all individual PAH analytes.

N-1.5 Estimation of Baseline for Inorganics in Soil

For the purposes of evaluating potential releases from AOCs, the inorganics selected for evaluation include only those analytes with numerical RSR criteria, including: antimony, arsenic, barium, beryllium, cadmium, chromium (total), copper, lead, mercury, nickel, selenium, silver, thallium, vanadium, and zinc. Two other detected inorganics, hexavalent chromium and cyanide, which have RSR criteria, have not been included in the evaluation due to their definitive use and documented release to soils at the Site. Detection of either hexavalent chromium or cyanide is therefore indicative of a release.

The selected inorganics have been detected in soils across the entire facility at varying concentrations. There are several possible sources for the inorganics detected in soils beneath the Site:

- Metals were machined and metal plating/finishing operations were conducted at the Site which may have resulted in releases to the soils.
- Fill materials brought onto the Site or those dredged from the Housatonic River may have contained elevated inorganics concentrations.
- The selected inorganics are naturally occurring in soils, as documented in numerous publications, including Shacklette and Boerngen, 1984.

Figures N-32 through N-46 present the concentration distribution plots for individual RSR inorganic analytes.

A review of the concentration distribution plots identifies several distinct patterns relevant to the evaluation of inorganics baseline concentrations at the SAEP Site. The ranked concentrations of several inorganic analytes, including antimony, silver, and thallium, increase gradually across the range of detected Site concentrations (see Figures N-32, N-33, and N-34). None of these analytes is known to be associated with historical practices at the site, and the pattern of concentrations does not suggest that a Site-related release has occurred. The remainder of the metals concentrations exhibit varying degrees of skewness in their distribution, with the highest concentrations often substantially elevated. These patterns may be indicative of Site-related influence at the sample locations at the high end of the plots. As an example, the distribution of nickel detected in Site sampling locations is presented in Figure N-41. The plotted concentrations above 37.6 ppm increase sharply to a maximum of 8052 ppm. The sampling locations where elevated concentrations (i.e., above the deflection point) were detected are identified in the inorganics plots (Figures N-32 through N-46).

The following table presents the selected deflection points, the geometric mean of the data, the maximum detected concentration, CTDEP RSR DEC, and the estimated arithmetic mean for eastern United States soils for inorganics (see Figures N-32 through N-46):

Inorganic Analyte	Estimated Deflection Point Concentration (ppm)	Geometric Mean of the Data (ppm)	Maximum Detected Concentration[1] (ppm)	CTDEP Residential DEC (ppm)	CTDEP Industrial/ Commercial DEC (ppm)	Estimated Arithmetic Mean – Eastern United States[2]
Antimony	-	1.8	69	27	8,200	0.76
Arsenic	8.7	3.3	**3,550**	10	10	7.4
Barium	114	27	1,891	4,700	140,000	420
Beryllium	0.627	0.28	**3.2**	2	2	0.85
Cadmium	7.2	0.57	**1,110**	34	1,000	-
Chromium (Total)	146	20	2,460	3,900	51,000	52
Copper	87.8	2.9	3,691	2,500	76,000	22
Lead	65.7	11.3	**19,700**	500	1,000	17
Mercury	0.405	0.10	6.5	20	610	0.12
Nickel	37.6	11.7	**8,052**	1,400	7,500	18
Selenium	0.37	0.36	1.51	340	10,000	0.45
Silver	-	1.5	9.9	340	10,000	-
Thallium	-	1.4	2.5	5.4	160	-
Vanadium	40.6	15	**657**	470	14,000	66
Zinc	175	39	19,100	20,000	610,000	52

1 - Bold values indicate concentrations > CTDEP RES and I/C DEC

2 - Shacklette and Boerngen, 1984

Comparison of the deflection point concentrations to the geometric mean of the data and to CTDEP RSR DEC indicate all deflection point concentrations are greater than the geometric mean and less than CTDEP RSR DEC. Comparison of the deflection point concentrations to the estimated arithmetic means (Shacklette and Boerngen, 1984) presents several scenarios:

- Barium, beryllium, selenium, and vanadium deflection point concentrations are less than the estimated arithmetic mean values; and

- Arsenic, copper, lead, mercury, nickel, and zinc deflection point concentrations are greater than the estimated arithmetic mean values; however deflection point values are no more than four times the arithmetic mean for any one inorganic analyte.

Given the presence of Site fill materials which were likely impacted by anthropogenic activities prior to placement on the site (i.e., Housatonic River sediments), the natural occurrence of the selected inorganics in soils in the eastern United States, and the limited number of samples with inorganics concentrations exceeding CTDEP RSR DEC, it is difficult to evaluate detected inorganics with respect to release from an AOC, with the exception of those AOCs associated with plating activities and dissolved metals solutions. The AOCs identified as having these types of activities are:

- AOC 8 – CWTP Collection System, Pump Station (Building B-63), and associated piping
- AOC 9 – Cyanide Destruction Facility in Building B-70

- AOC 10 – CWTP in Building B-18
- AOC 31 – Building B-6 and associated satellite accumulation areas
- AOC 34 – Building B-3A and associated satellite accumulation areas
- AOC 39 – Building B-4 former Brine UST
- AOC 50 – Building B-2 Plating Area
- AOC 51 – Building B-3 Plating Area
- AOC 56 – Research and Development Area in northern Building B-3, Building B-3A, and Building B-4

Review of historical SAEP documents indicates that the following inorganics were associated w/ processes at these AOCs: cadmium, chromium (total), copper, cyanide, hexavalent chromium, and nickel.Historical documents also indicate the use of mercury manometers, leaded gasoline, zinc chromate paint, zinc phosphate, and zincate (zinc coating) at the Site.

Therefore, detected concentrations of cadmium, chromium (total), copper, cyanide, hexavalent chromium, and nickel above the estimated deflection point concentrations will be used for determination of potential releases of inorganics from AOCs. As hexavalent chromium and cyanide are not naturally occurring in soils, any detection of these two analytes will be considered as evidence of a release. Concentrations of lead, mercury, and zinc may be associated with potential releases, however the use of these metals was more limited than for the other Site-related metals, and concentrations of these three inorganics above deflection points were generally limited to areas that received fill adjacent to the Dike.

N-1.6 Estimation of Baseline for TPH in Soil

TPH has been detected in soils across the entire facility at varying concentrations. There are several possible sources for the TPH detected in soils beneath the Site, including fuel releases and fill material.

Figure N-47 presents a concentration distribution plot for TPH in site soils. A review of the concentration distribution plot identifies skewness in the distribution, with the highest concentrations substantially elevated. This pattern is likely indicative of Site-related influence at the sample locations at the high end of the plots. The plotted concentrations above the estimated deflection point concentration of 872 ppm increase sharply to a maximum of 10,400 ppm. Therefore, detected concentrations of TPH in soil above the estimated deflection point concentration of 872 ppm will be used for determination of potential releases of TPH from AOCs.

APPENDIX N-2

EVALUATION OF SITE BASELINE CONCENTRATIONS FOR INORGANICS IN GROUNDWATER
STRATFORD ARMY ENGINE PLANT

This appendix presents an evaluation of baseline conditions with respect to the concentrations of inorganic analytes detected in groundwater at the Stratford Army Engine Plant Site. This analysis includes a review of detected concentrations of the analytes in Site groundwater samples for the purpose of establishing a baseline values, or range of concentrations, for these analytes to be used in the determination of potential releases of contaminants from Areas of Concern (AOCs). Detailed discussions of the sample observations and proposed baseline concentrations for release determinations are provided in the following paragraphs.

Section N-2.1 provides a summary of the data set used to evaluate baseline conditions. Section N-2.2 provides an overview of the methodology used to evaluate the Site groundwater data. The evaluation of the Site groundwater baseline concentrations for inorganics is provided in Section N-2.3.

N-2.1 Groundwater Samples Included in the Baseline Evaluation

The Site lacks a typical "background" groundwater data set representative of groundwater un-impacted by site activities; therefore, the existing site-wide groundwater data have been used for this evaluation. Groundwater samples from all aquifer depths and geologic units were selected for evaluation. Specific groundwater samples which were eliminated from the data set include:

- Pilot-scale and bench-scale testing groundwater samples in the vicinity of the former Chromium Plating Facility.
- Unfiltered direct-push groundwater samples, which had high turbidity readings.

It is important to note that many of the Site groundwater samples were obtained from groundwater in areas of former industrial activity and some from areas of identified contaminant releases.

N-2.2 Methodology for Evaluation of Site Groundwater

The evaluation of the Site surface groundwater baseline concentrations for inorganics included the following steps:

- The Geographic Information System (GIS) database was queried for detected inorganics.
- Concentration distribution plots were created for the individual inorganic analytes. Analyte concentrations were rank ordered and plotted on graphs to identify patterns in analyte concentration distributions in the Site data set. The analytical data were ranked from lowest to highest concentration for the purposes of plotting in each of these figures.
- The concentration distribution plots were reviewed to qualitatively identify the deflection points (i.e., the concentration at which the distribution begins to increase substantially). The deflection point is defined as an obvious increase in the slope of the plot that may be used to distinguish between a subset of the data that may be normally-distributed and consistent with baseline concentrations, and sampling locations that may have been influenced by historical practices at the Site.

The following subsection presents an assessment of Site groundwater inorganics concentrations, with a proposed determination of baseline concentration to be used in identifying potential releases of contaminants from AOCs.

N-2.3 Estimation of Baseline for Inorganics in Groundwater

For the purposes of evaluating potential releases from AOCs, the inorganics selected for evaluation include only those analytes with numerical RSR criteria, including: antimony, arsenic, barium, beryllium, cadmium, chromium (total), copper, lead, mercury, nickel, selenium, silver, thallium, vanadium, and zinc. Two other detected inorganics, hexavalent chromium and cyanide, which have RSR criteria, have not been included in the evaluation due to their definitive use and documented release to soils at the Site. Detection of either hexavalent chromium or cyanide is therefore indicative of a release.

The selected inorganics have been detected in groundwater across the entire facility at varying concentrations. There are several possible sources for the inorganics detected in groundwater beneath the Site:

- Metals were machined and metal plating/finishing operations were conducted at the Site which may have resulted in releases to the soils and groundwater.
- Fill materials brought onto the Site or those dredged from the Housatonic River may have contained elevated concentrations of inorganics, which could have been leached to groundwater.
- The selected inorganics are naturally occurring in soils, as documented in numerous publications, including Shacklette and Boerngen, 1984, and may have leached to groundwater

Figures N-48 through N-62 present the concentration distribution plots for individual RSR inorganic analytes in groundwater.

A review of the concentration distribution plots identifies several distinct patterns relevant to the evaluation of inorganics baseline concentrations at the SAEP Site. The ranked concentrations of several inorganic analytes, including antimony, mercury, and selenium, increase gradually across the range of detected Site concentrations (see Figures N-48, N-56, and N-58). None of these analytes is known to be associated with historical practices at the site, and the pattern of concentrations does not suggest that a Site-related release has occurred. The remainder of the metals concentrations exhibit varying degrees of skewness in their distribution, with the highest concentrations often substantially elevated. These patterns may be indicative of Site-related influence at the sample locations at the high end of the plots. As an example, the distribution of total chromium detected in Site sampling locations is presented in Figure N-53. The plotted concentrations above 95 ppm increase sharply to a maximum of 950 ppm. The sampling locations where elevated concentrations (i.e., above the deflection point) were detected are identified in the inorganics plots (Figures N-48 through N-62).

The following table presents the estimated deflection points, CTDEP RSR surface water protection criteria (SWPC), and the Ambient Water Quality Criteria (Saltwater Chronic) for the selected inorganics in groundwater (see Figures N-48 through N-62):

Inorganic Analyte	Estimated Deflection Point Concentration (ppm)	Geometric Mean of the Data (ppm)	CTDEP SWPC (ppm)	CTDEP AWQC SW Acute (ppm)	CTDEP AWQC SW Chronic (ppm)
Antimony	‘-	0.023	86	‘-	-
Arsenic	0.02	0.011	0.004	0.069	0.036
Barium	0.194	0.051	-	‘-	-
Beryllium	0.627	0.00022	0.004	‘-	-
Cadmium	0.0044	0.0021	0.006	0.042	0.0093
Chromium (Total)	95	0.899	0.11	‘-	-
Copper	0.085	0.017	0.048	0.0048	0.0031
Lead	0.0086	0.005	0.013	0.21	0.0081
Mercury	-	0.00028	0.0004	0.0018	0.00094

Inorganic Analyte	Estimated Deflection Point Concentration (ppm)	Geometric Mean of the Data (ppm)	CTDEP SWPC (ppm)	CTDEP AWQC SW Acute (ppm)	CTDEP AWQC SW Chronic (ppm)
Nickel	0.063	0.013	0.88	0.074	0.0082
Selenium	-	0.005	50	0.29	0.071
Silver	0.09	0.008	0.012	0.00196	-
Thallium	0.099	0.007	0.063	‘-	-
Vanadium	0.0088	0.014	-	‘-	-
Zinc	0.075	0.026	0.123	0.09	0.081

Review of historical SAEP documents indicates that the following inorganics were associated with plating processes at SAEP: cadmium, chromium (total), copper, cyanide, hexavalent chromium, and nickel.

Historical documents also indicate the use of mercury manometers, leaded gasoline, zinc chromate paint, zinc phosphate, and zincate (zinc coating). However, analysis of mercury concentrations did not result in determination of a deflection point, and the distribution of elevated lead concentrations is not consistent with areas where metals are known to have been released or used. Zinc is present in the vicinity of the former B-2 Chromium Plating Facility, and adjacent to the CWTP transfer line in the South Parking Lot at concentrations greater than the deflection point; however, zinc is also present at elevated concentrations in areas where metals are not known to have been used/released (West Parking Lot, B-19, and the west end of B-16). Historical information suggests zinc may be attributable to a release in the vicinity of the former B-2 Chromium Plating Facility and adjacent to the CWTP transfer line in the South Parking Lot.

Therefore, detected concentrations of cadmium, chromium (total), copper, and nickel above the estimated deflection point concentrations will be used for determination of potential releases of inorganics from AOCs. As hexavalent chromium and cyanide are not naturally occurring in groundwater, any detection of these two analytes will be considered as evidence of a release.

APPENDIX N

LIST OF FIGURES

APPENDIX N – REFERENCES

Shacklette, H.T. and J.G. Boerngen, 1984. Element Concentrations in Soils and Other Surficial Materials of the Conterminous United States; U.S. Geological Survey Professional Paper 1270; U.S. Government Printing Office, Washington.

Figure N-1
1,1,1-TCA Concentrations in Soil

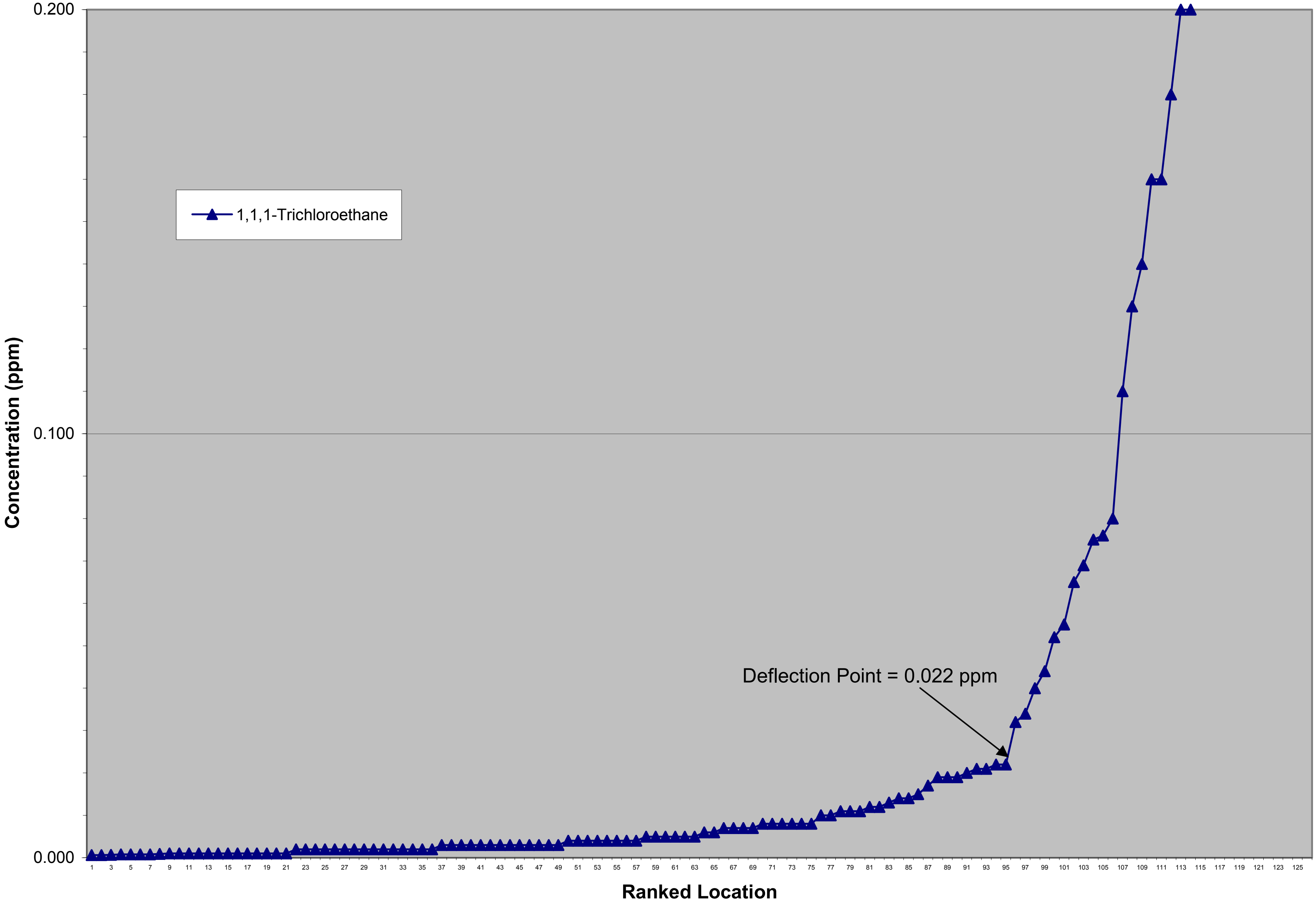


Figure N-2
1,1,2-TCA Concentrations in Soil

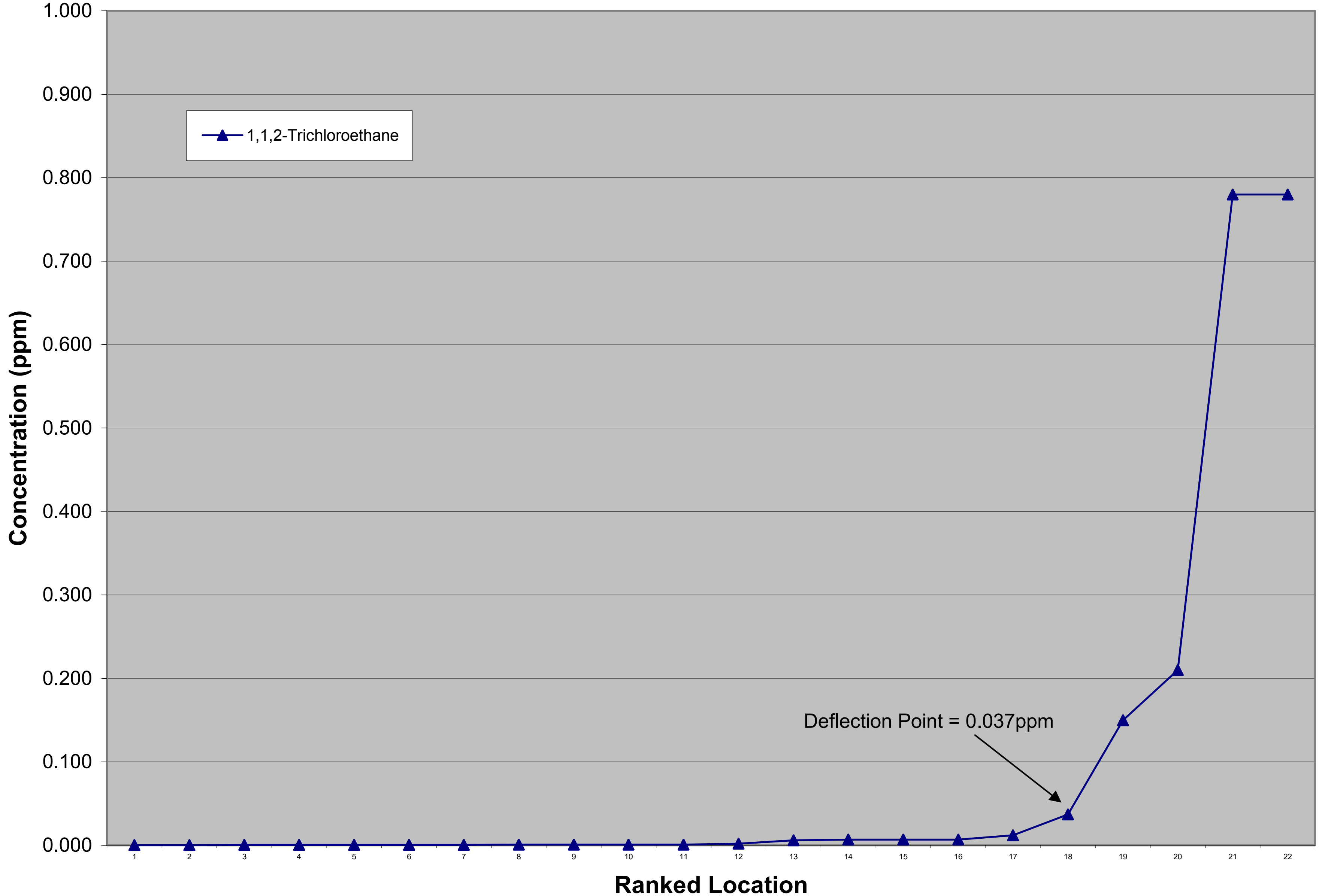


Figure N-3
1,1,2,2-TCA Concentrations in Soil

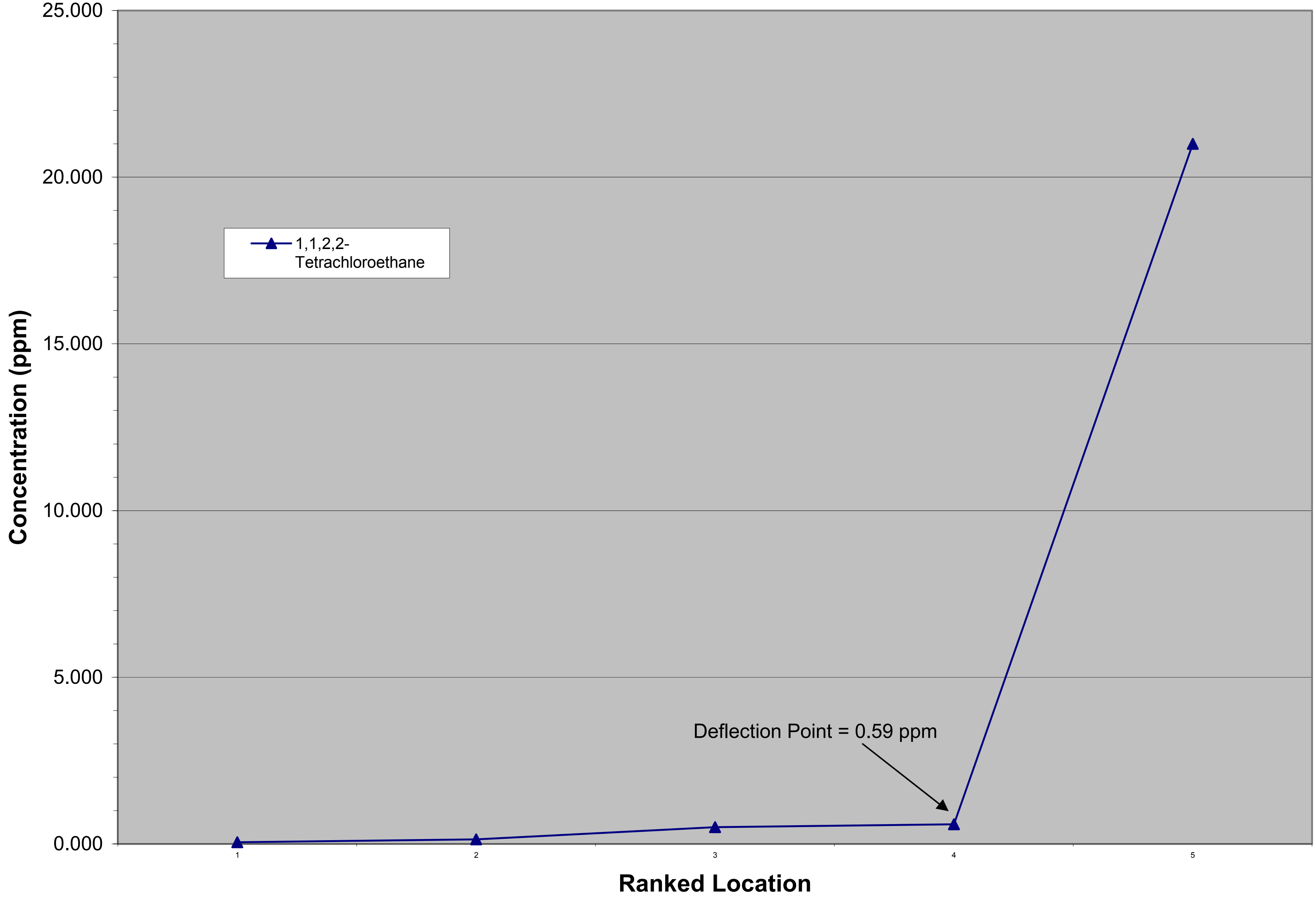


Figure N-4
1,1-DCA Concentrations in Soil

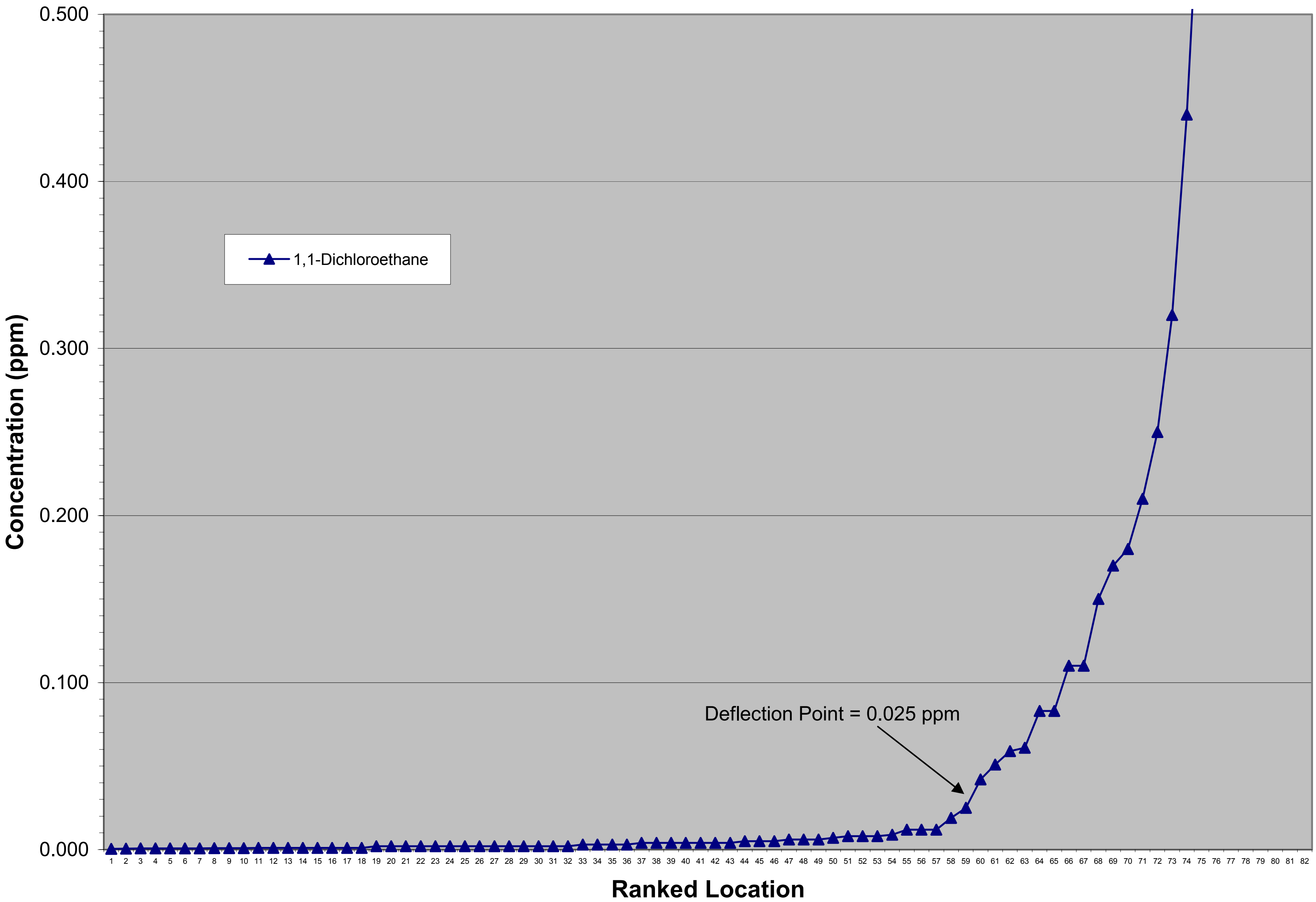


Figure N-5
1,1-DCE Concentrations in Soil

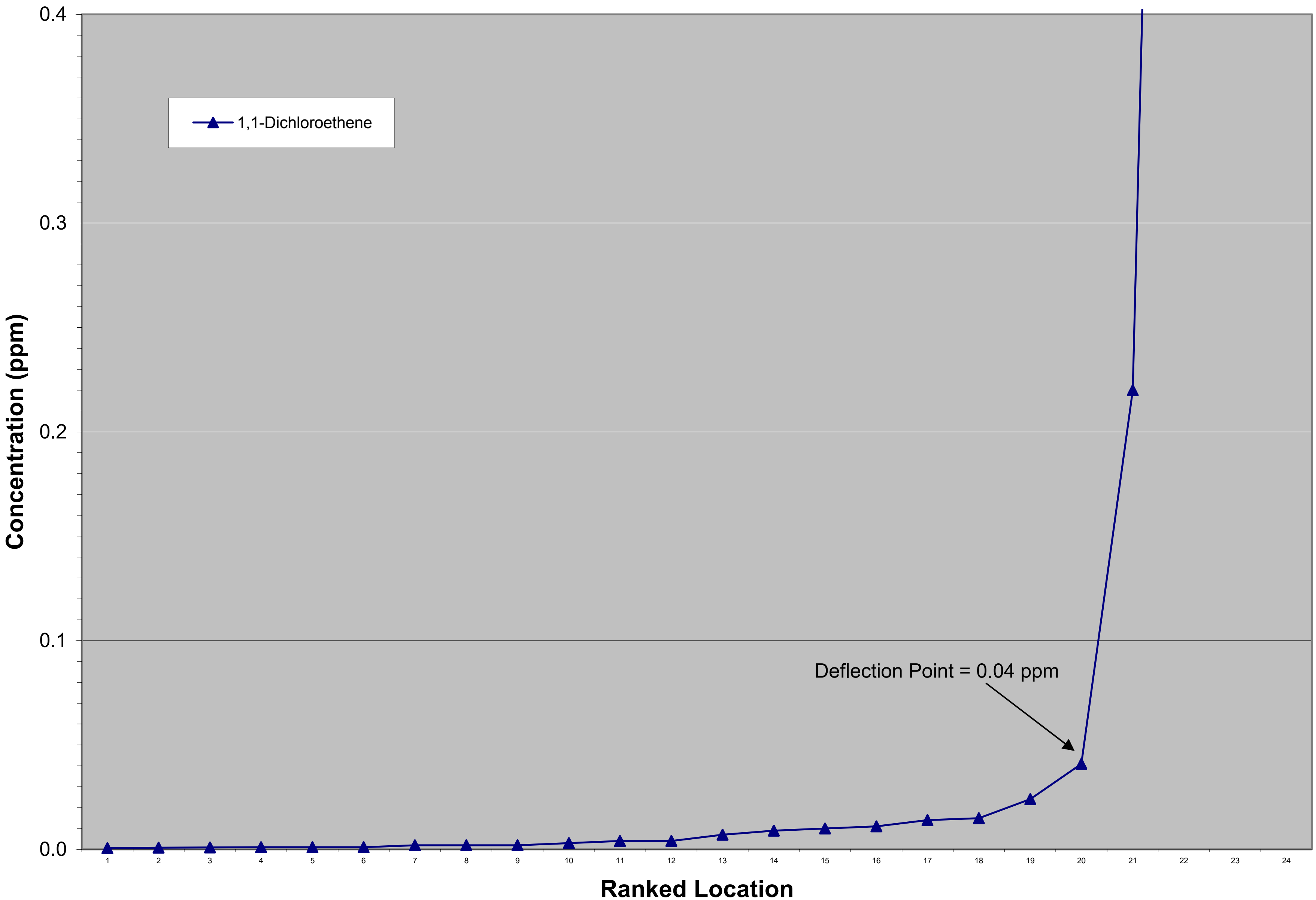


Figure N-6
PCE Concentrations in Soil

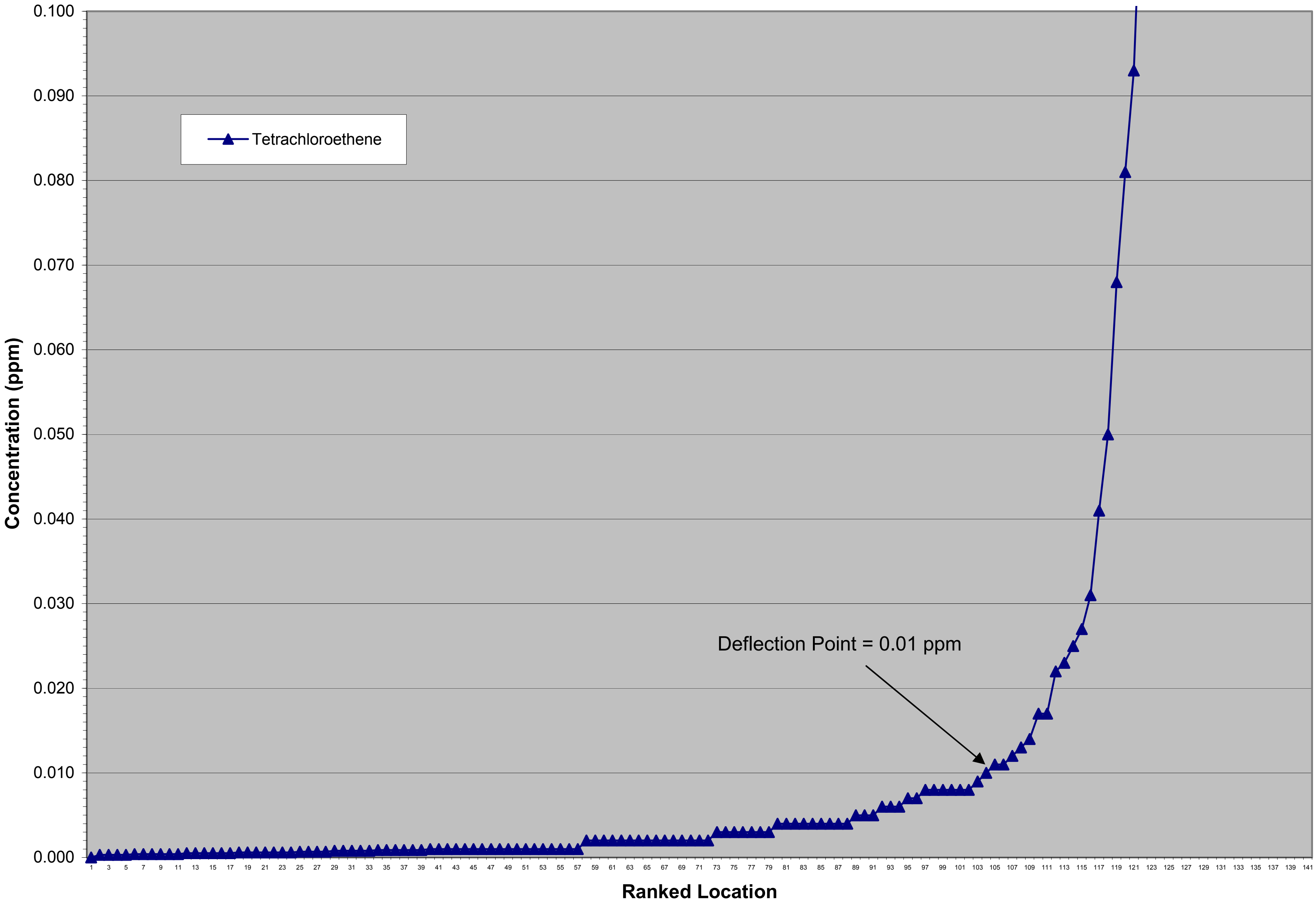
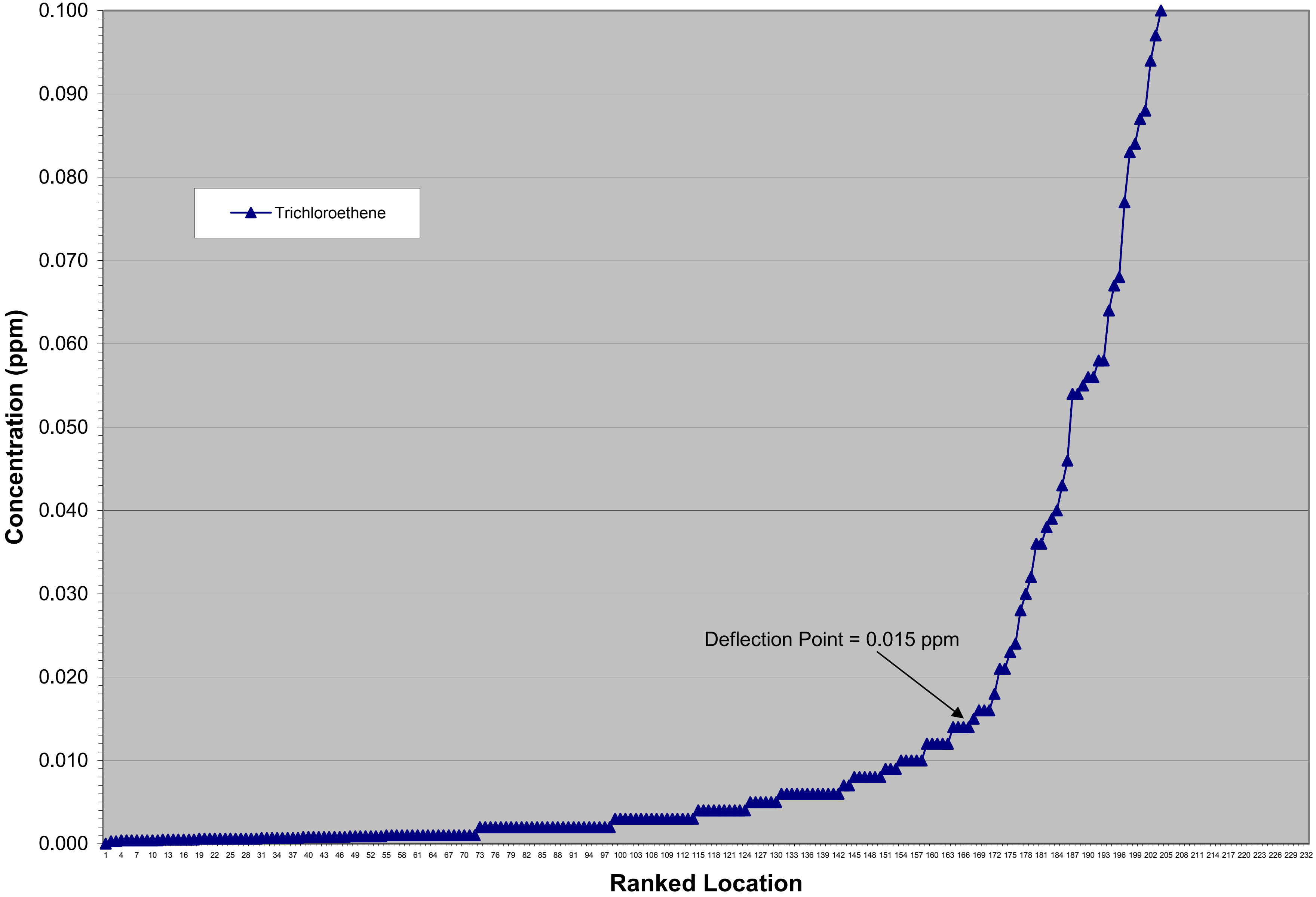


Figure N-7
TCE Concentrations in Soil



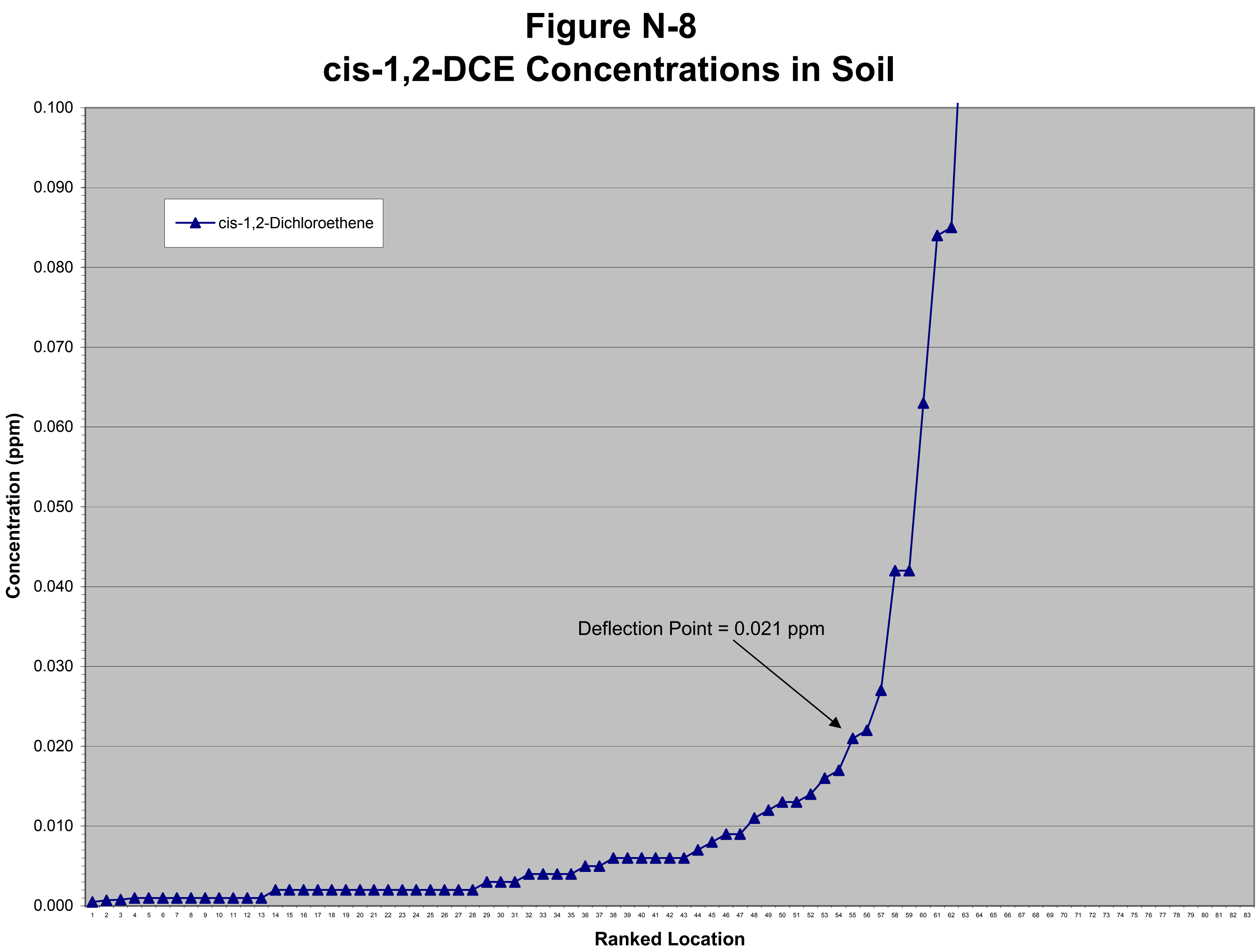


Figure N-8
cis-1,2-DCE Concentrations in Soil
0.100
0.090
0.080
0.070
0.060
0.050
0.040
0.030
0.020
0.010
0.000
Concentration (ppm)
cis-1,2-Dichloroethene
Deflection Point = 0.021 ppm
Ranked Location

Figure N-9
Vinyl Chloride Concentrations in Soil

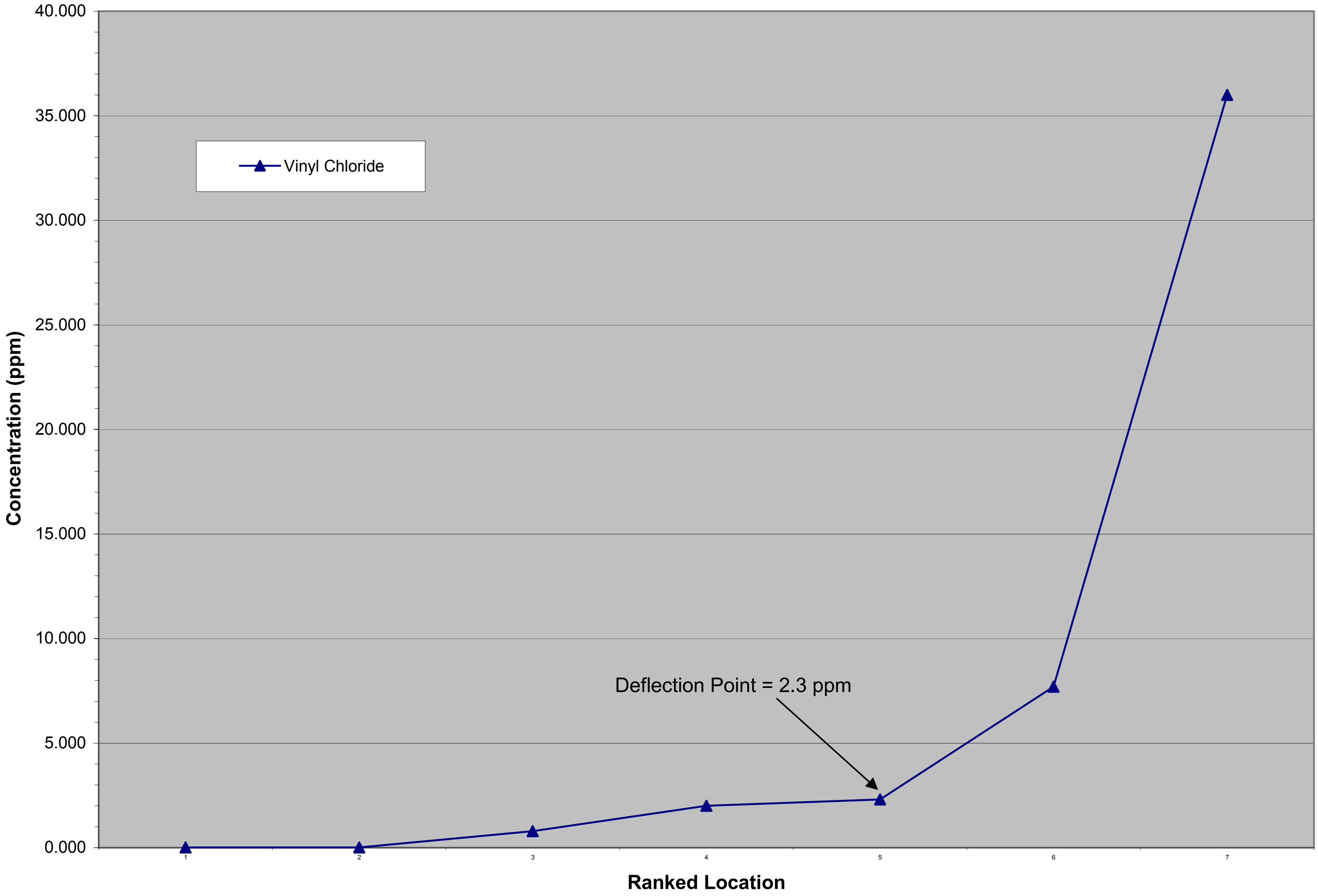
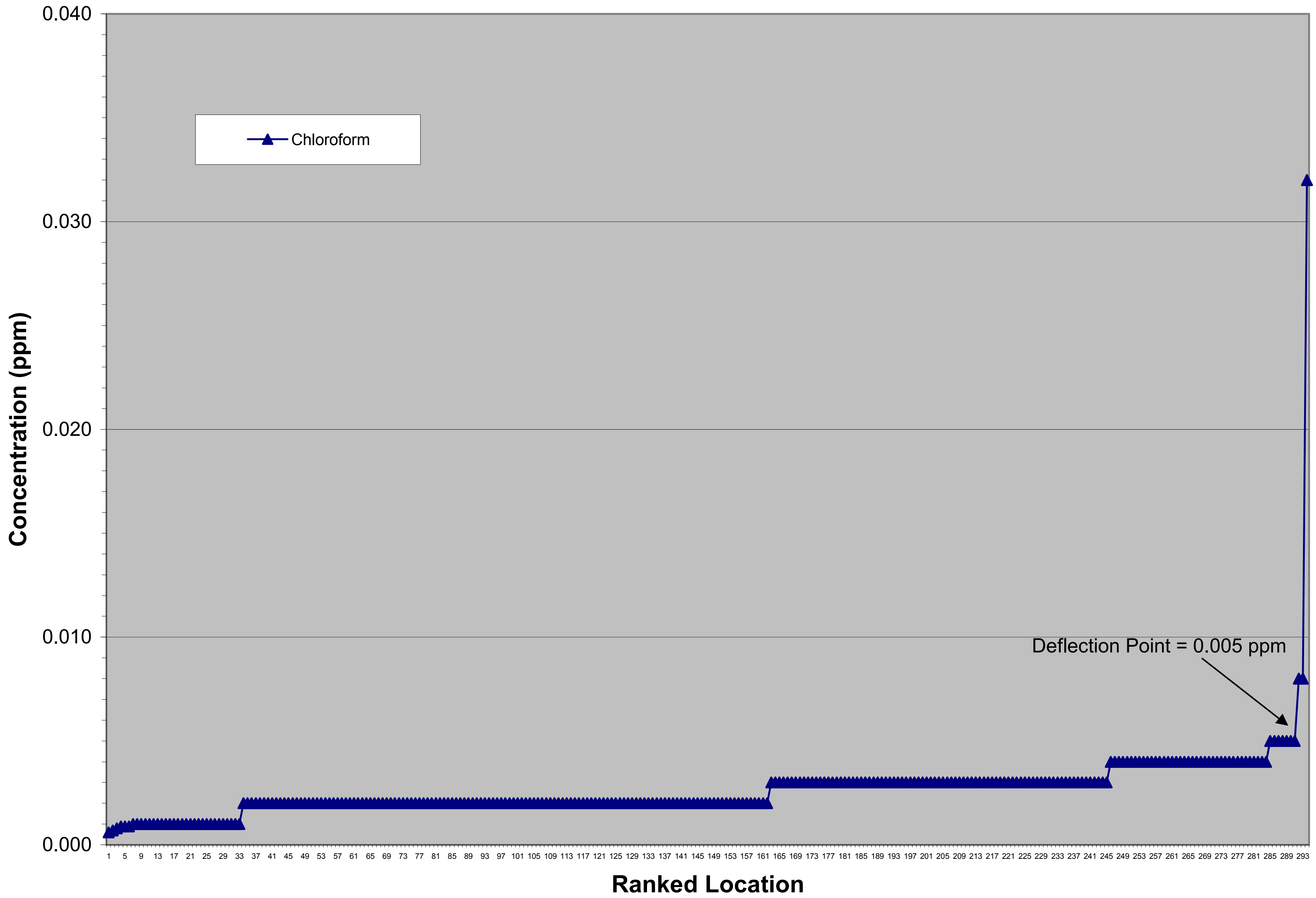


Figure N-10
Chloroform Concentrations in Soil



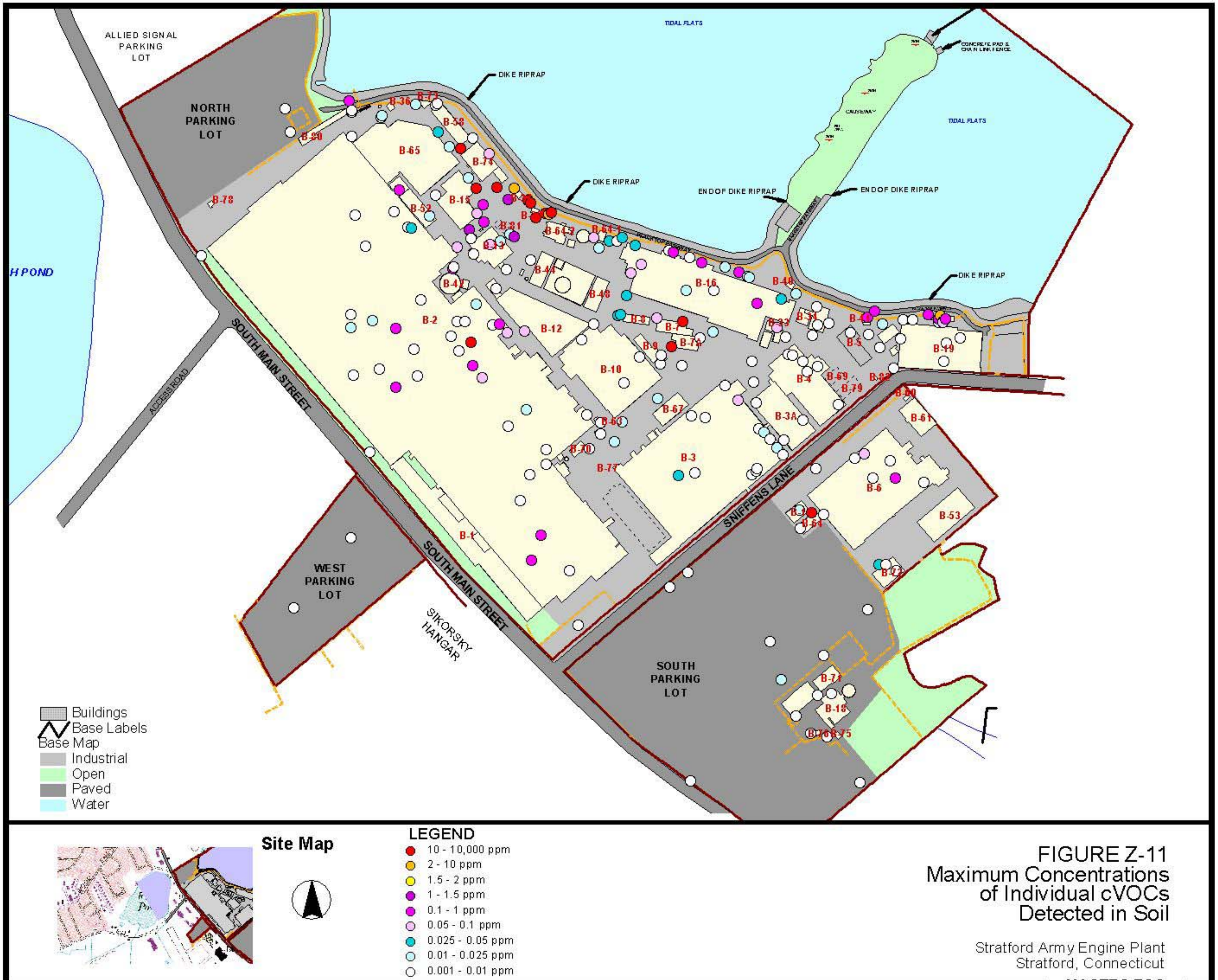


FIGURE Z-11
Maximum Concentrations of Individual cVOCs Detected in Soil

Stratford Army Engine Plant
Stratford, Connecticut

MACTEC E&C

Figure N-12
PAH Concentrations in Soil

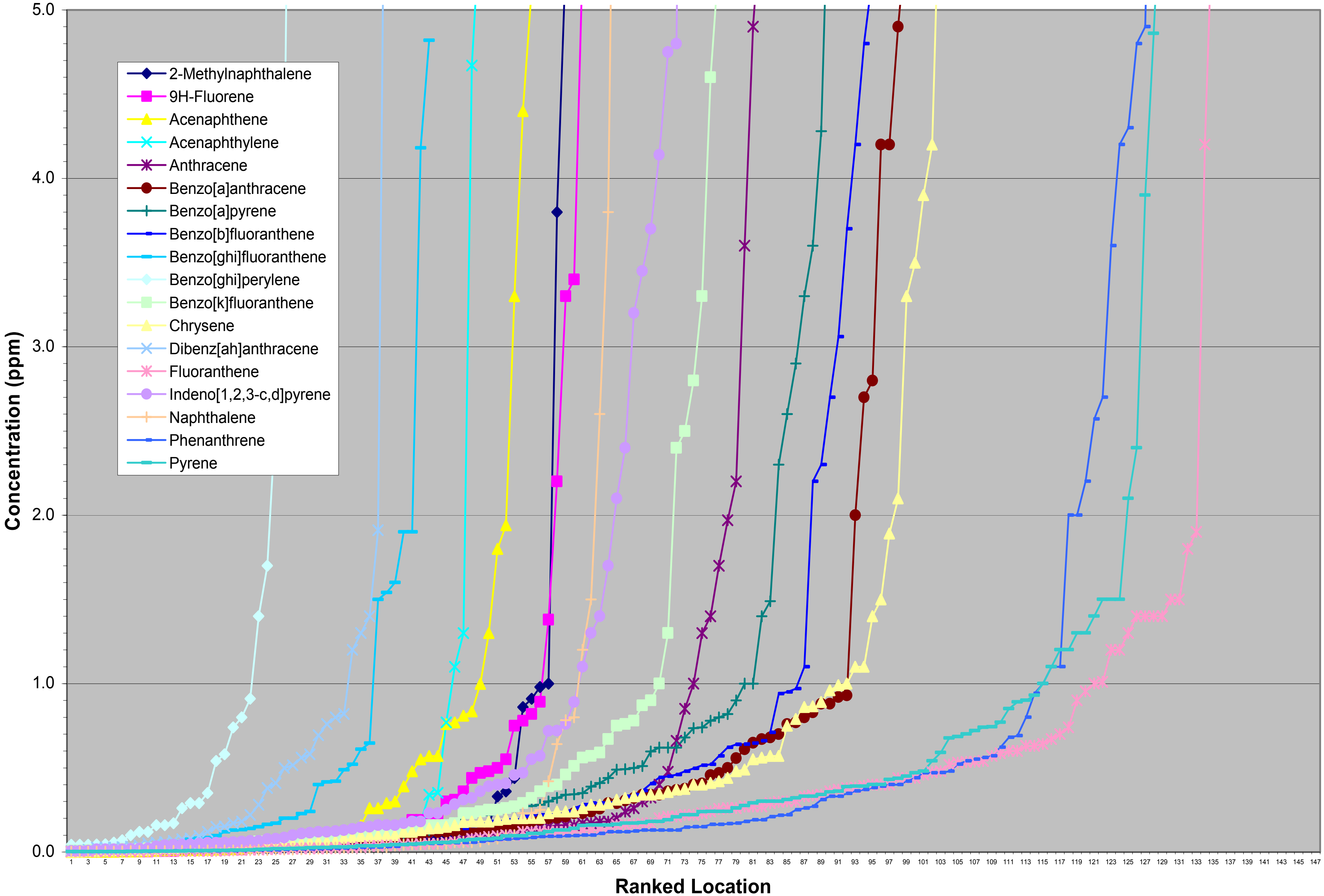


Figure N-13
2-Methylnaphthalene Concentrations in Soil

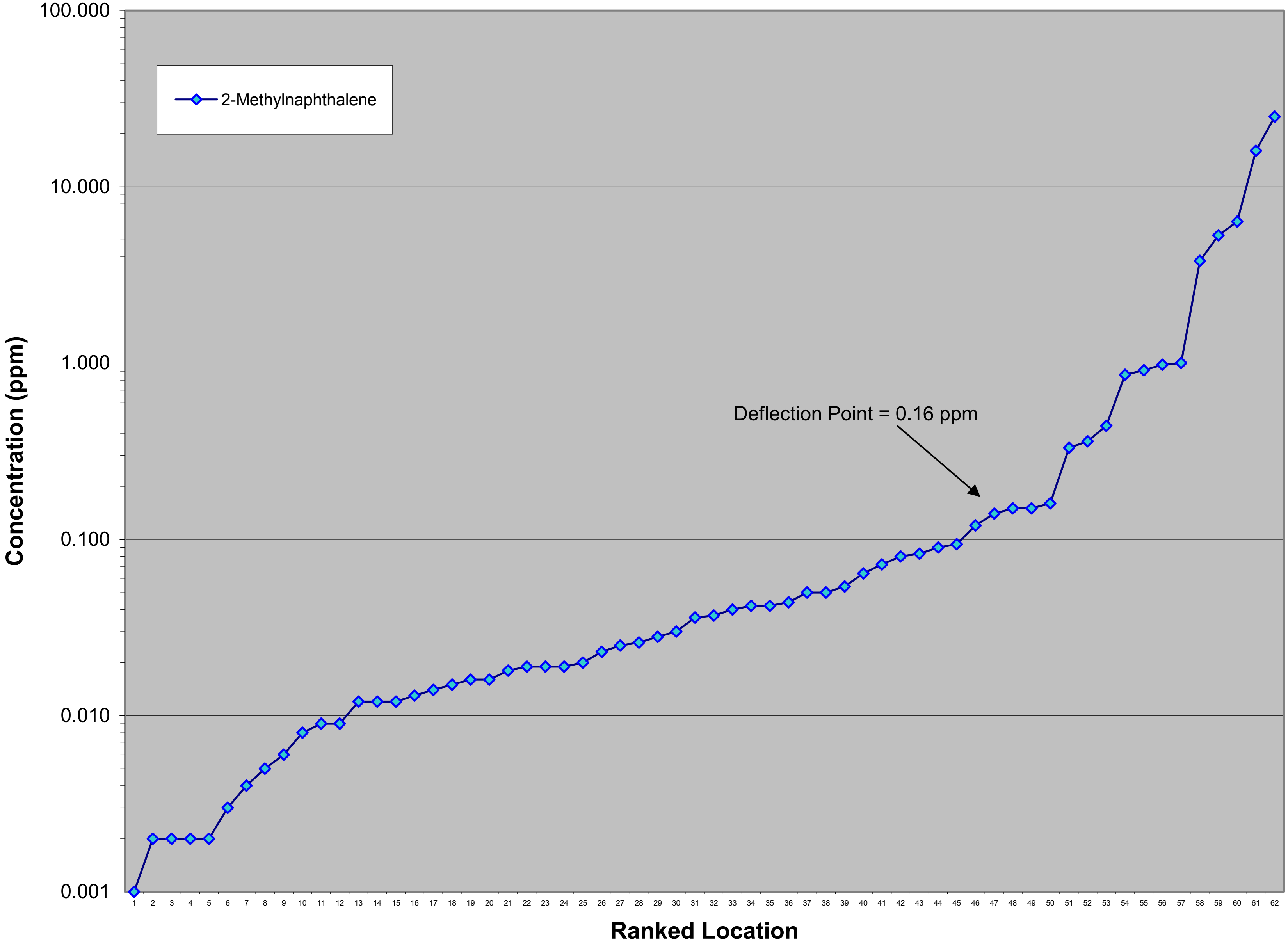


Figure N-14
9H-Flourene Concentrations in Soil

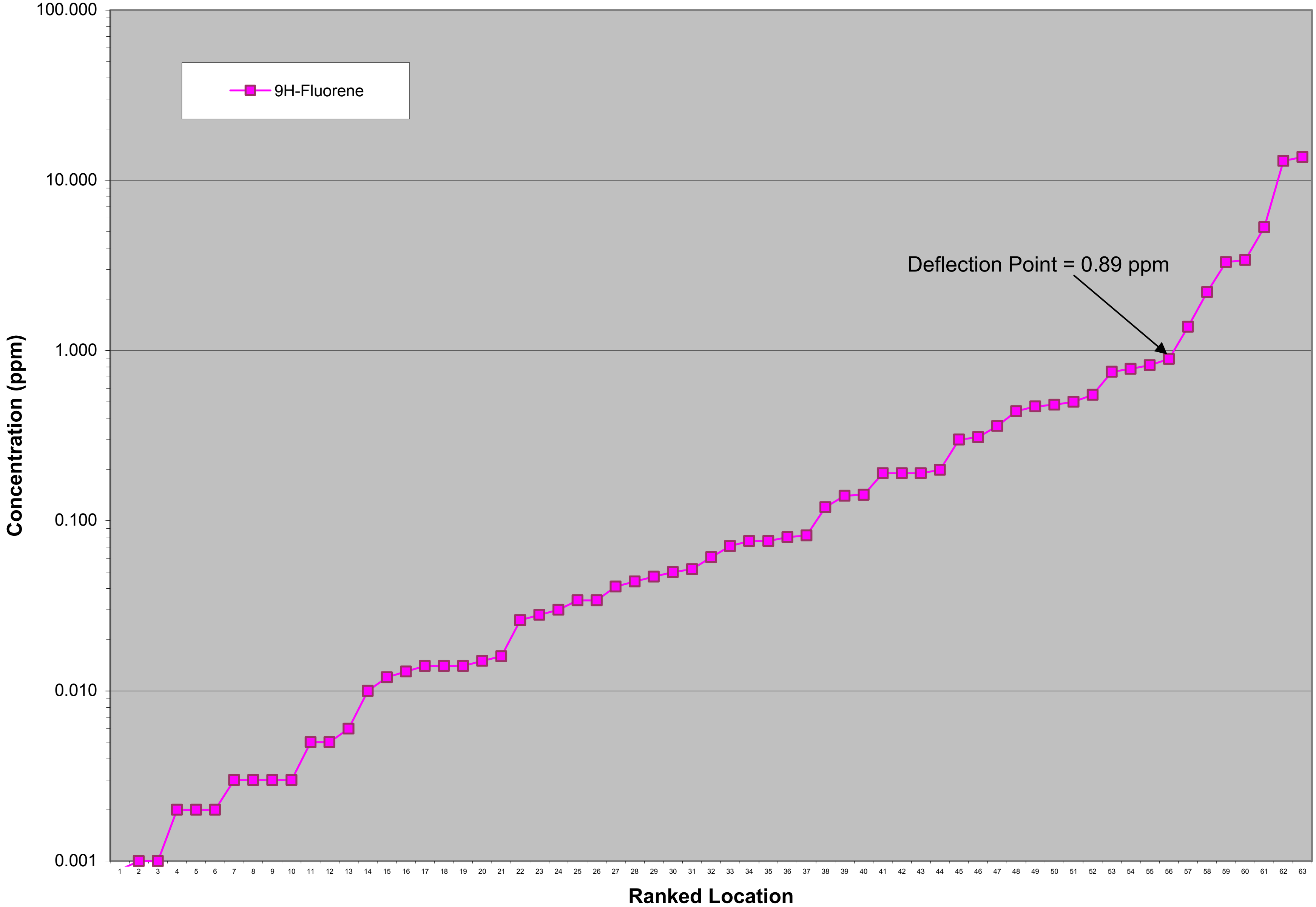


Figure N-15
Acenaphthene Concentrations in Soil

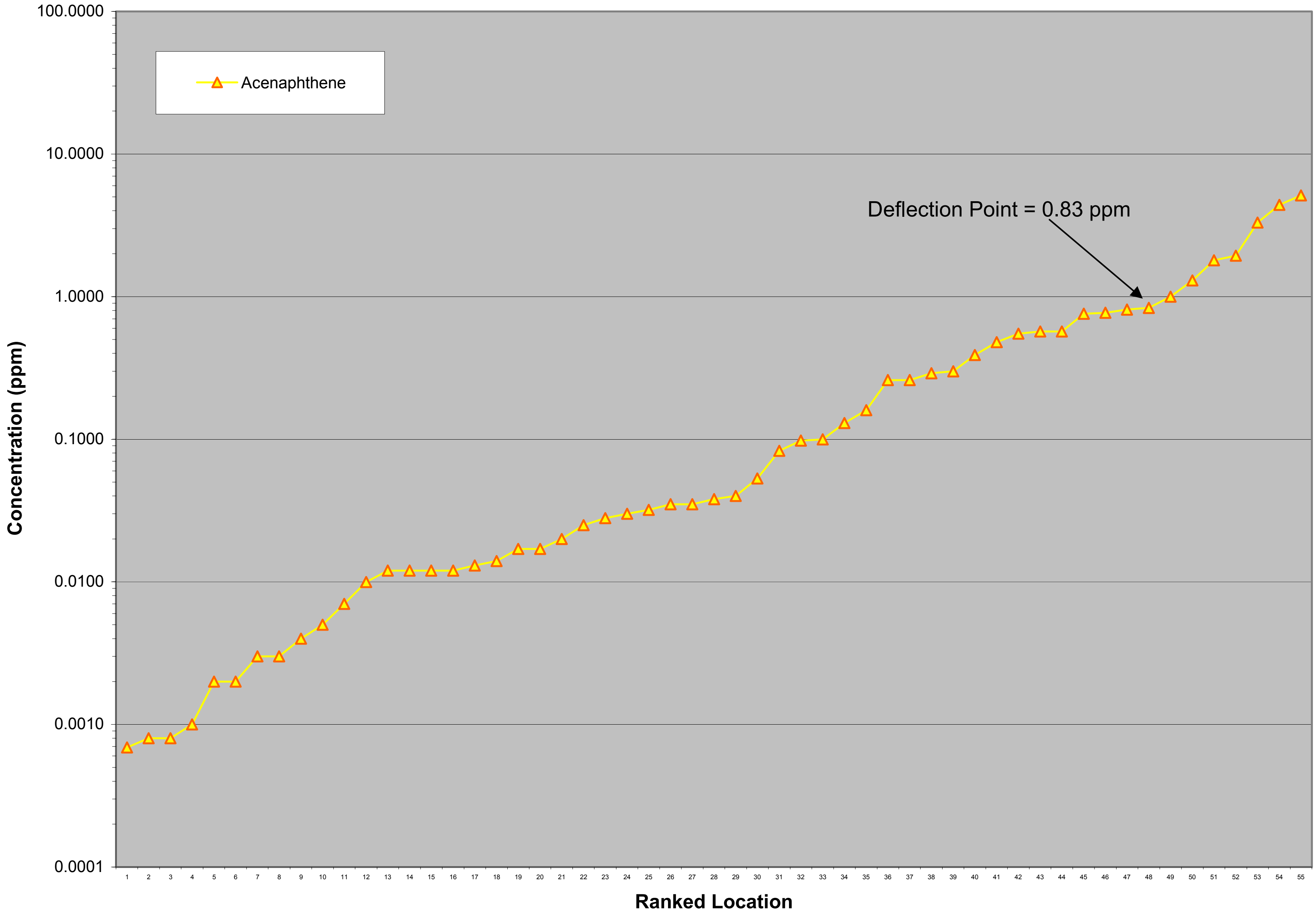


Figure N-16
Acenaphthylene Concentrations in Soil

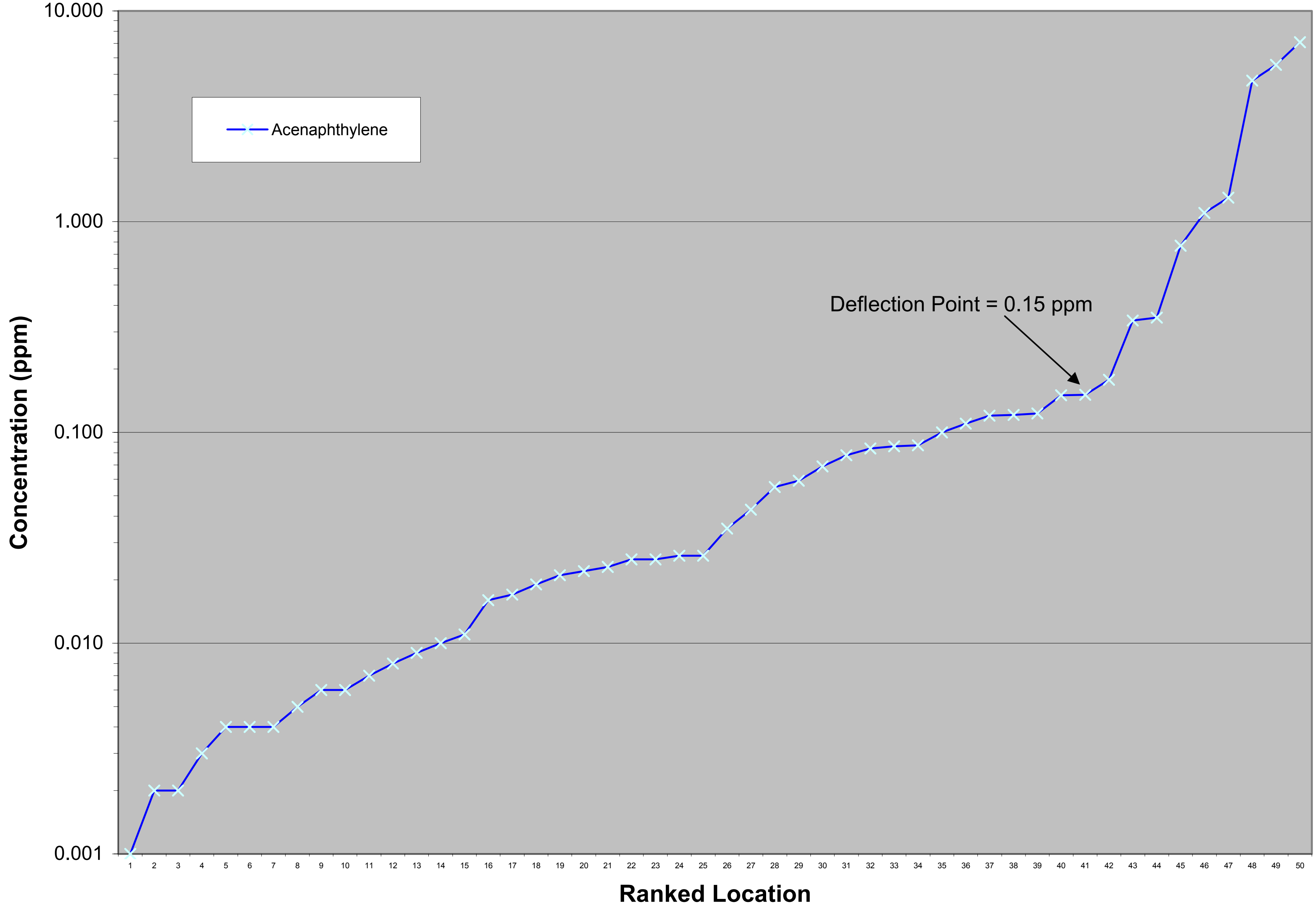


Figure N-17
Anthracene Concentrations in Soil

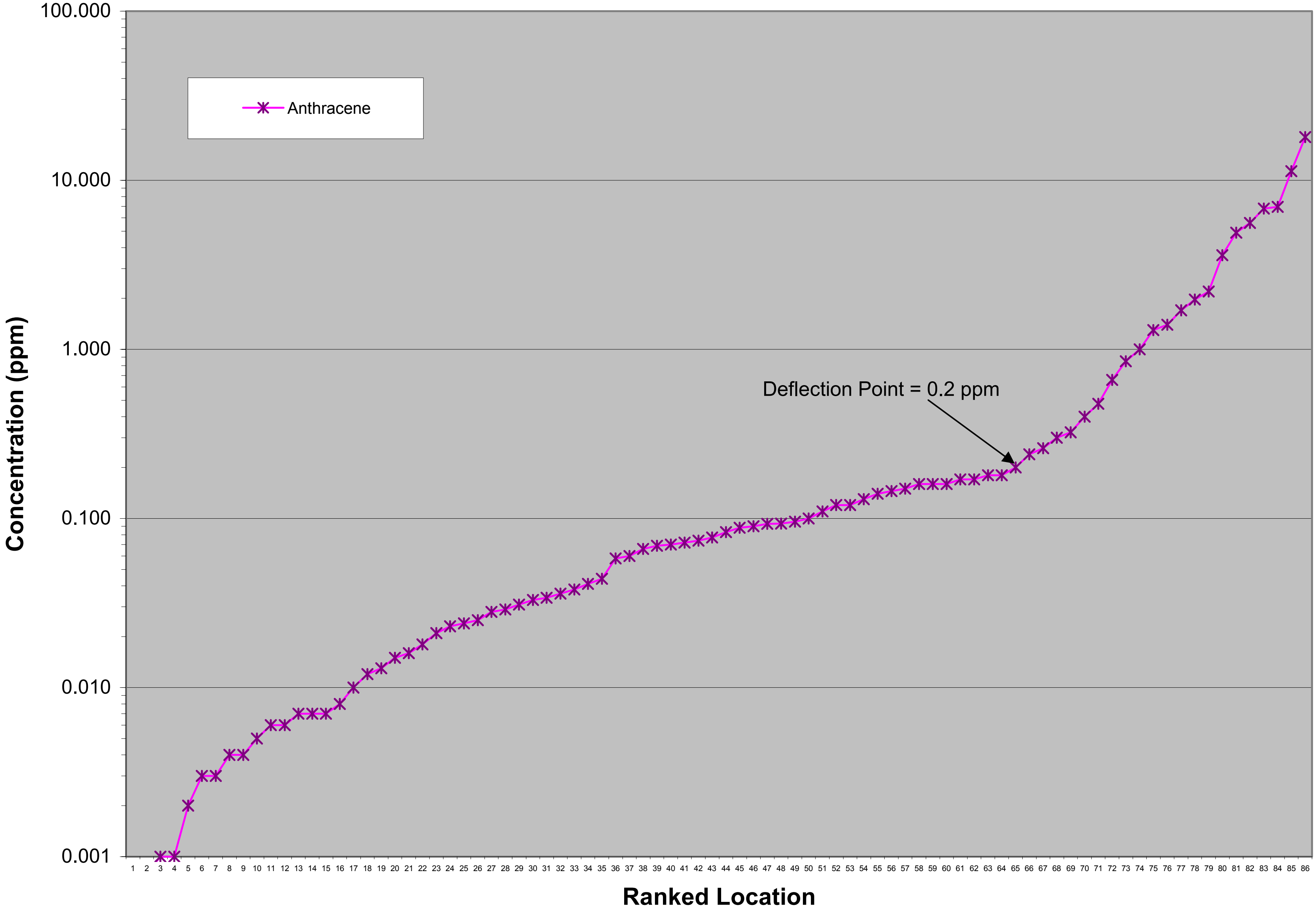


Figure N-18
Benzo(a)anthracene Concentrations in Soil

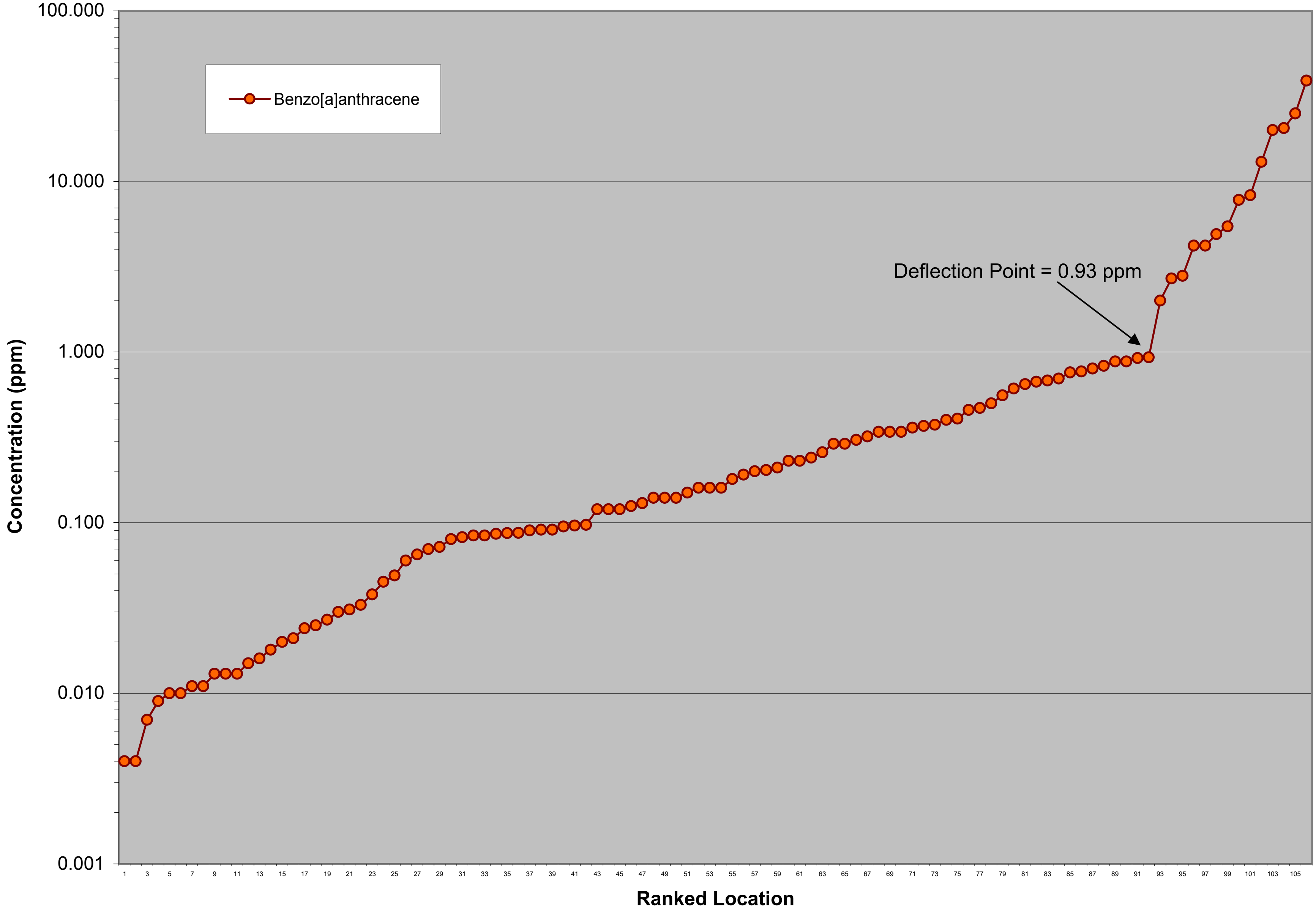


Figure N-19
Benzo(a)pyrene Concentrations in Soil

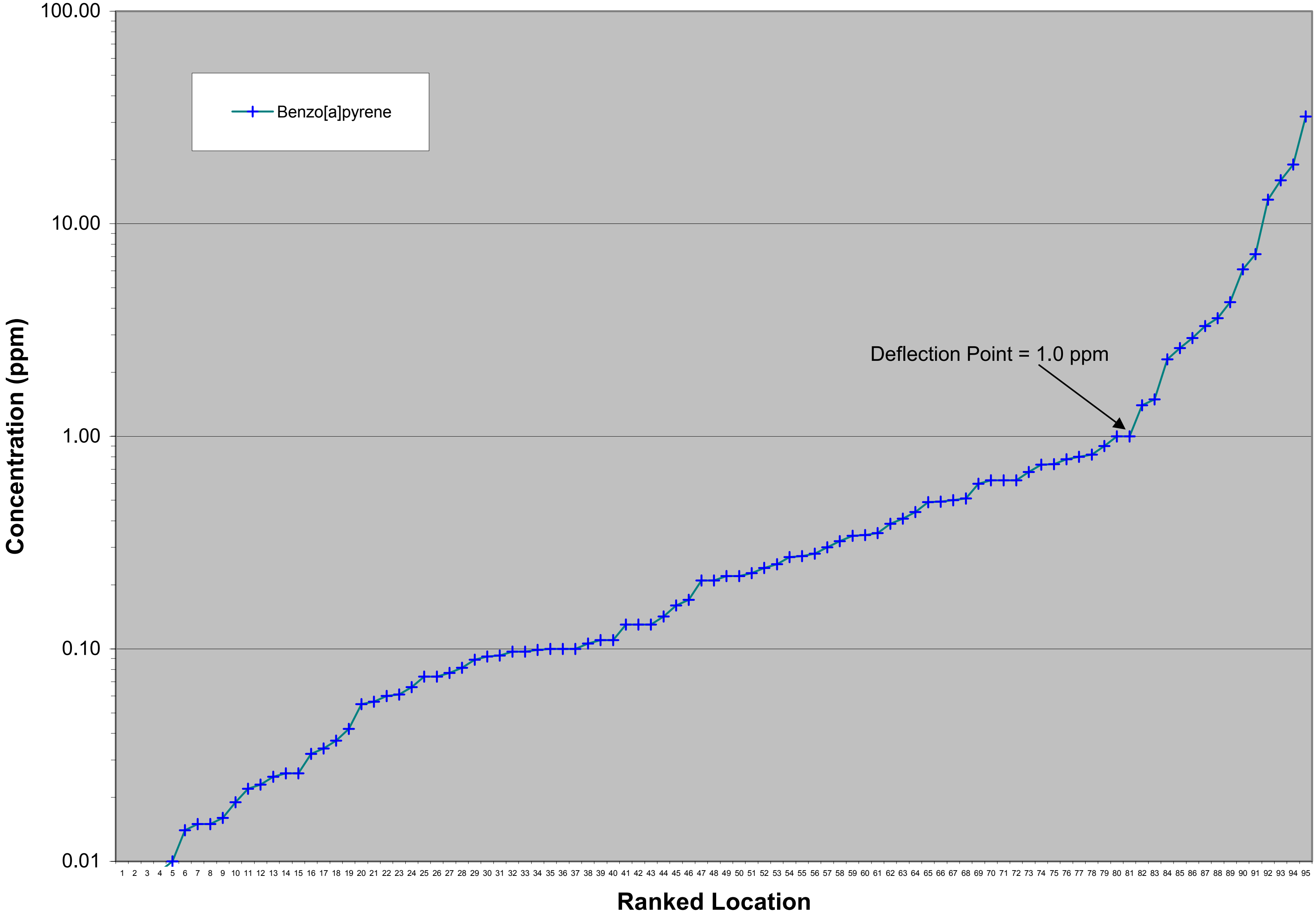


Figure N-20
Benzo(b)fluoranthene Concentrations in Soil

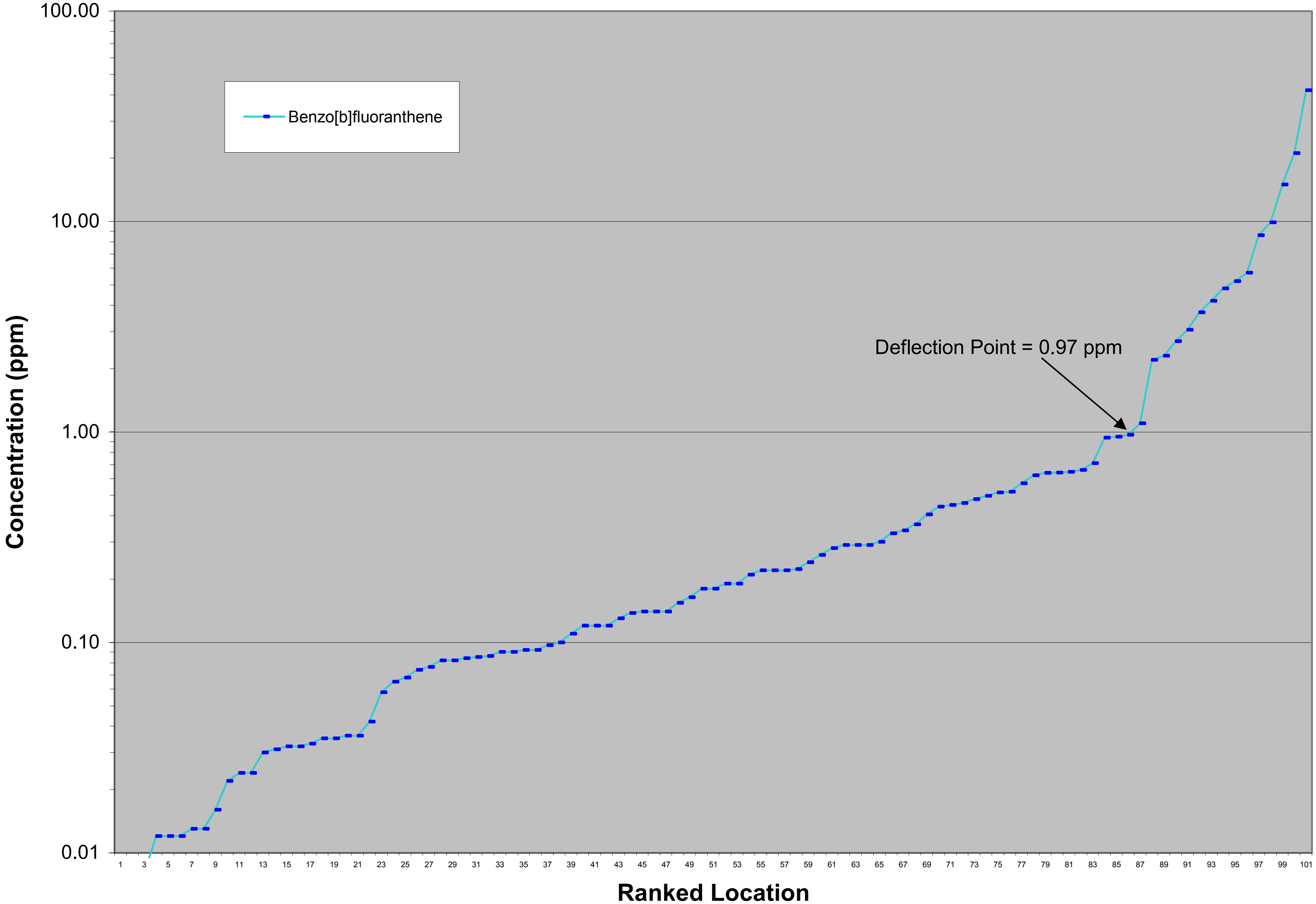


Figure N-21
Benzo(ghi)fluoranthene Concentrations in Soil

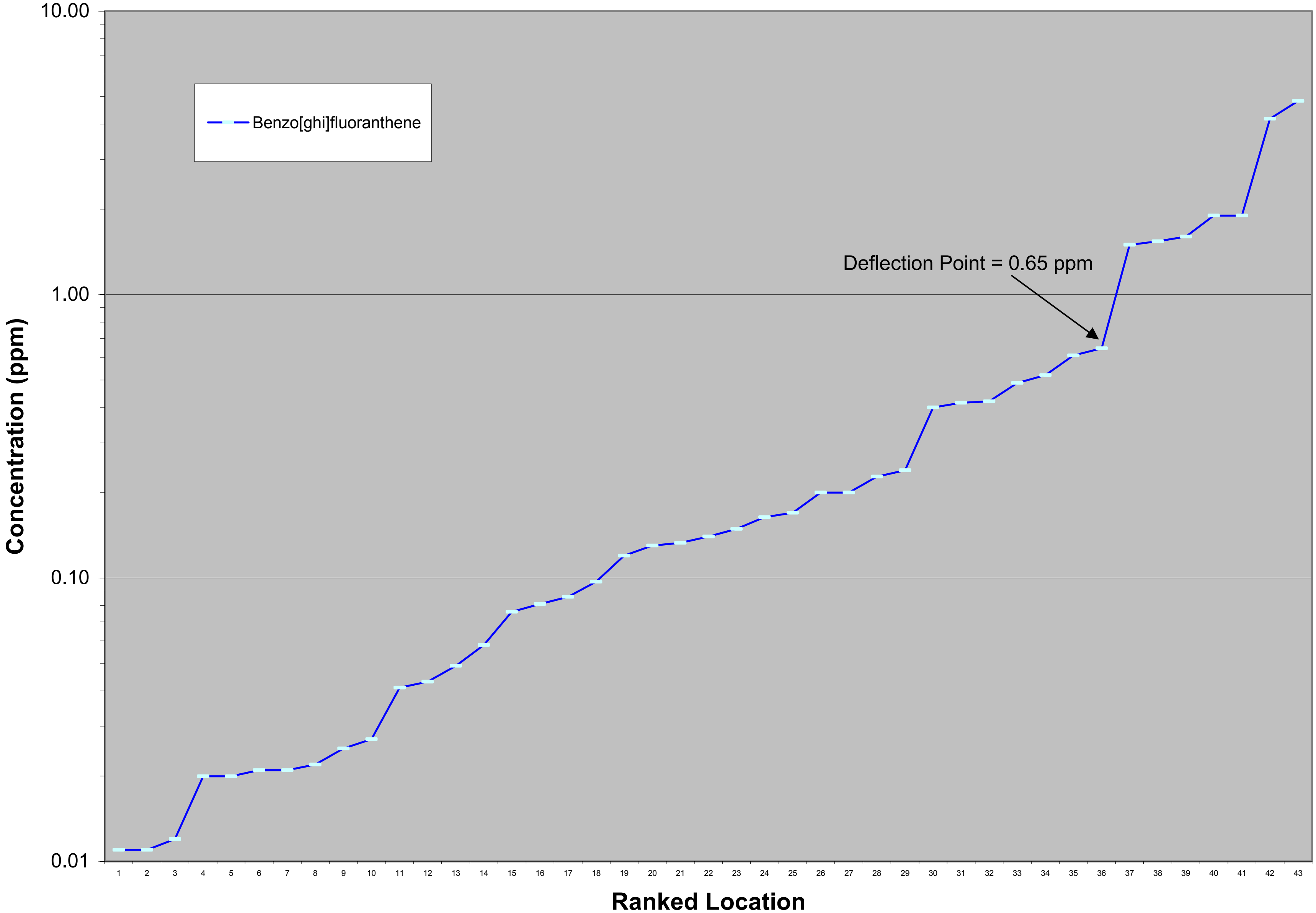


Figure N-22
Benzo(ghi)perylene Concentrations in Soil

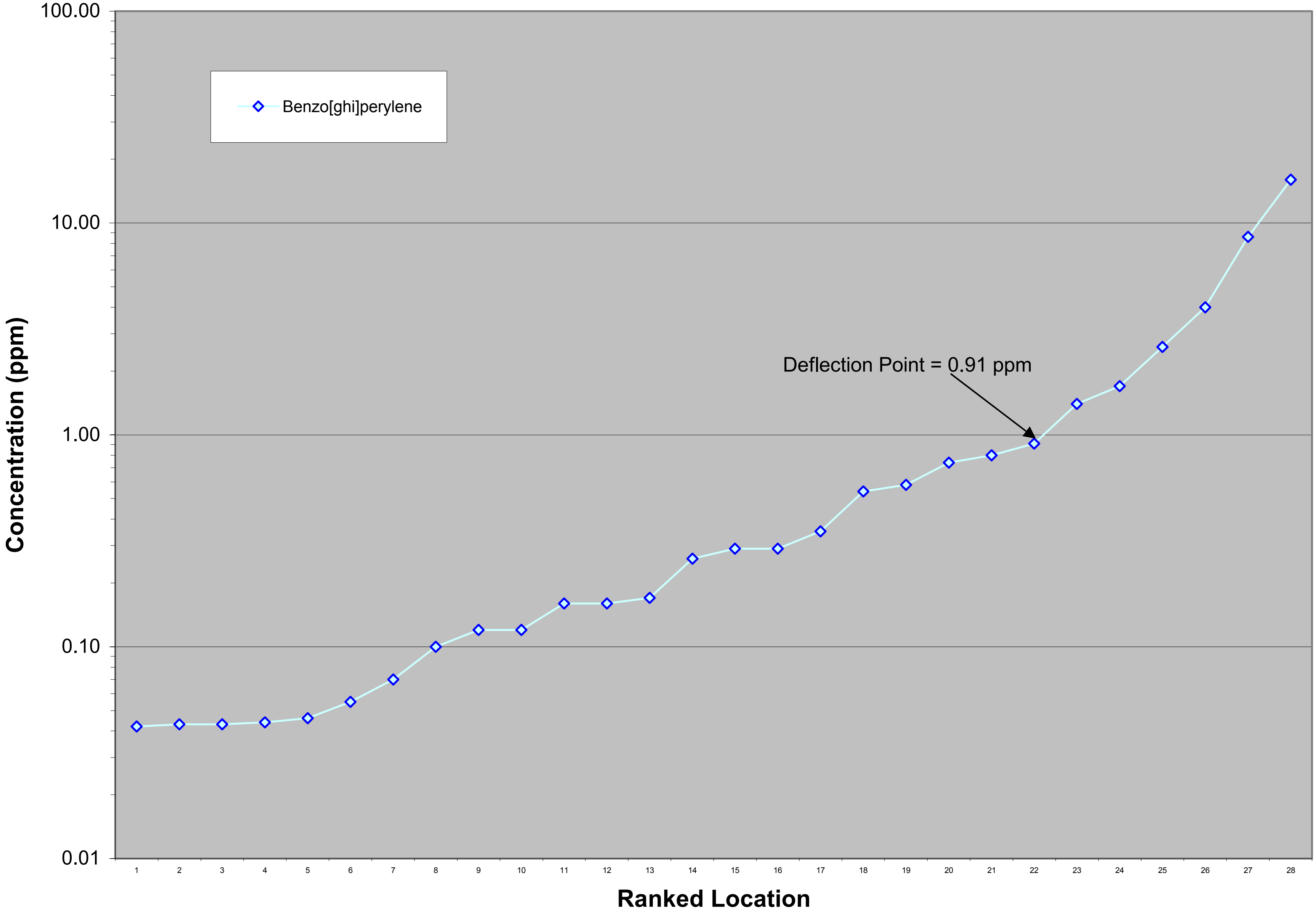


Figure N-23
Benzo(k)flouranthene Concentrations in Soil

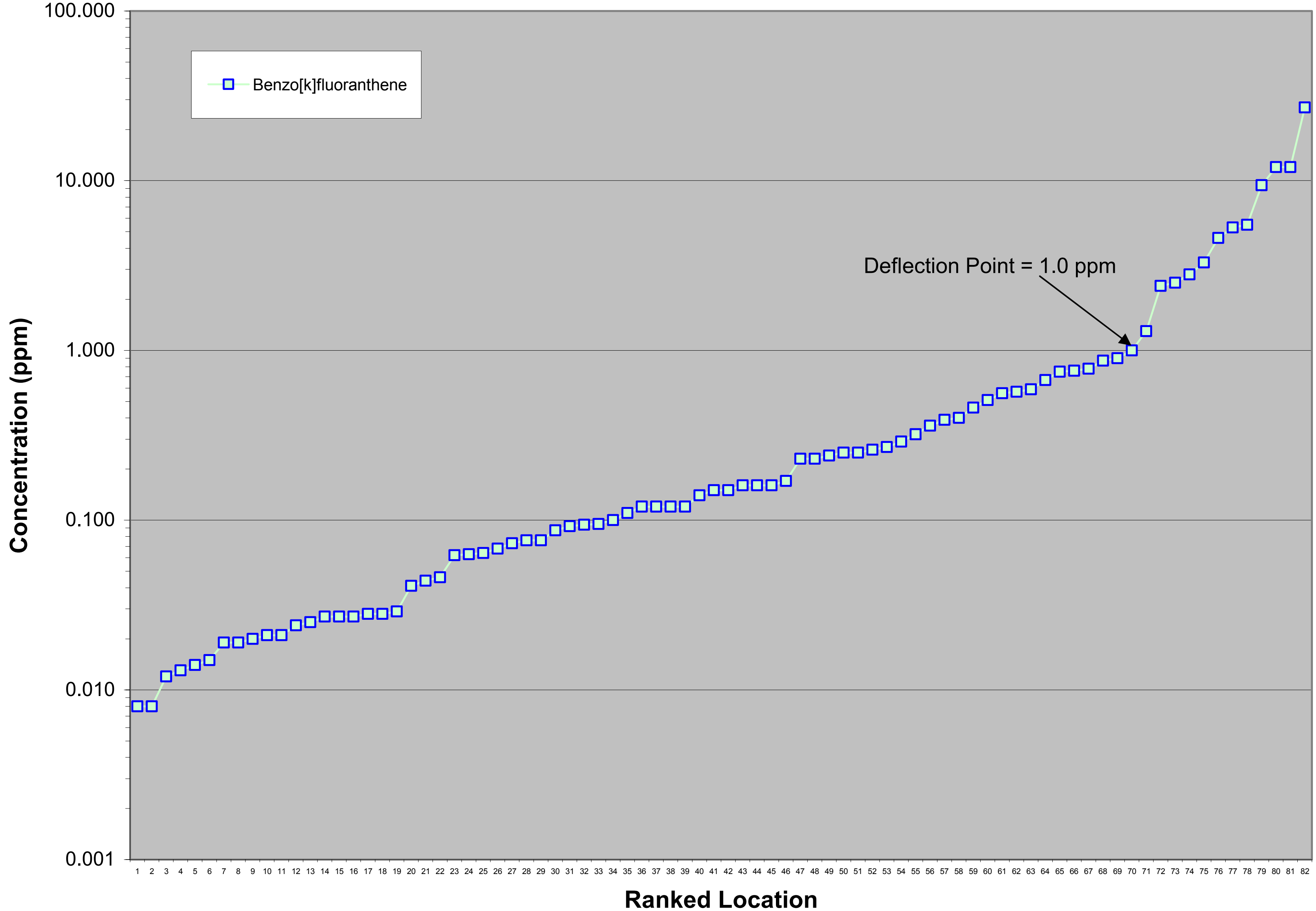


Figure N-24
Chrysene Concentrations in Soil

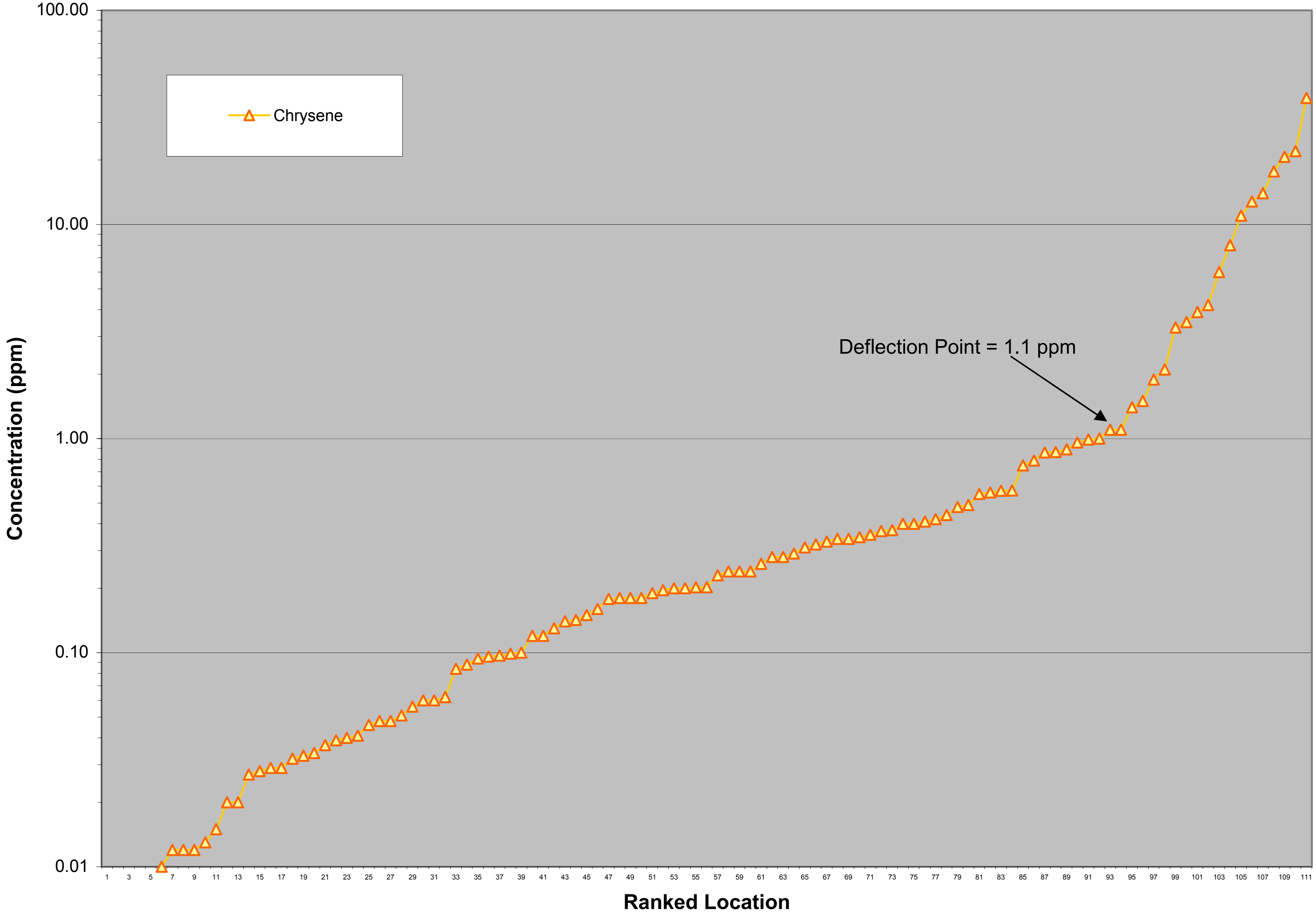


Figure N-25
Dibenz(ah)anthracene Concentrations in Soil

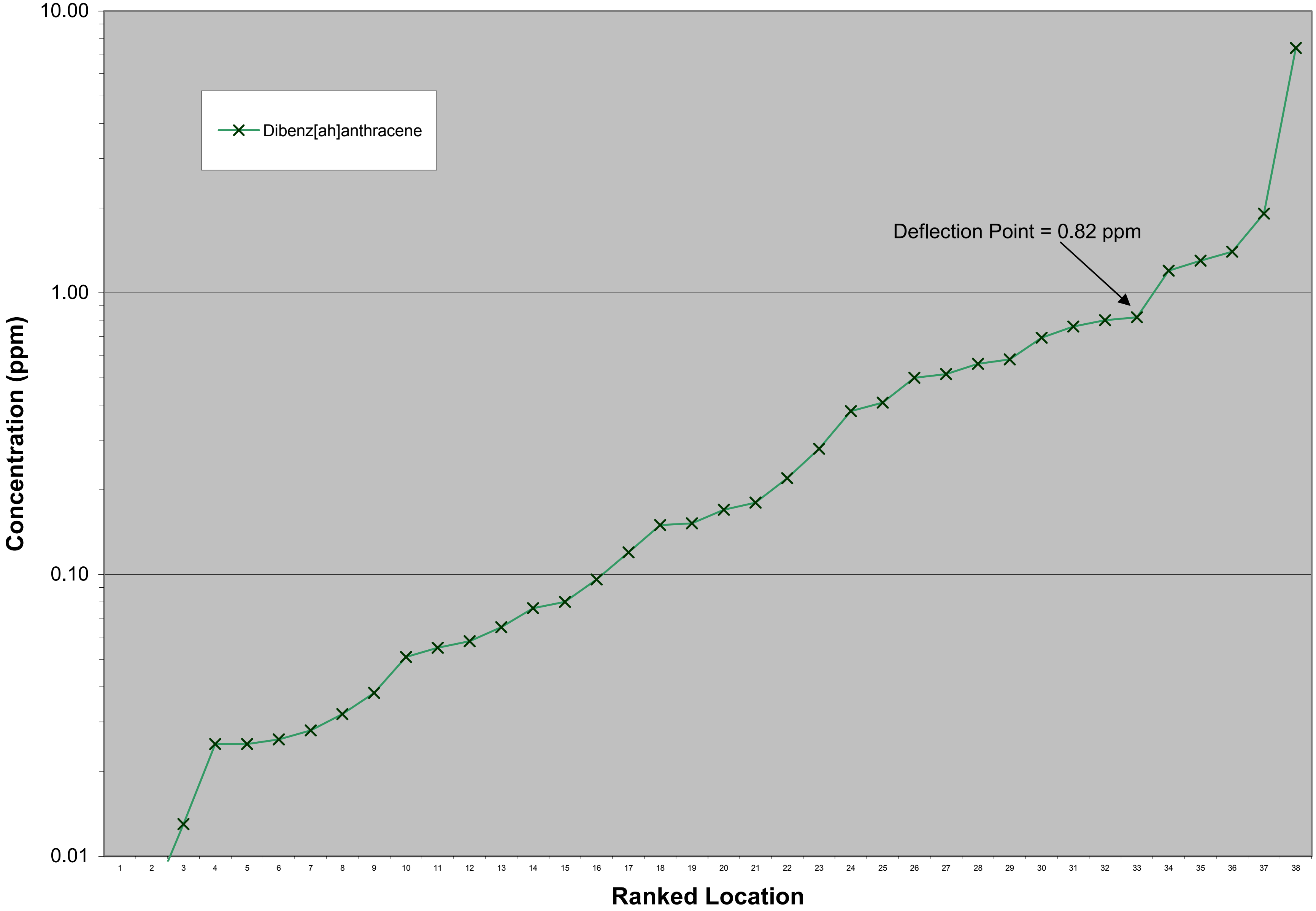


Figure N-26
Fluoranthene Concentrations in Soil

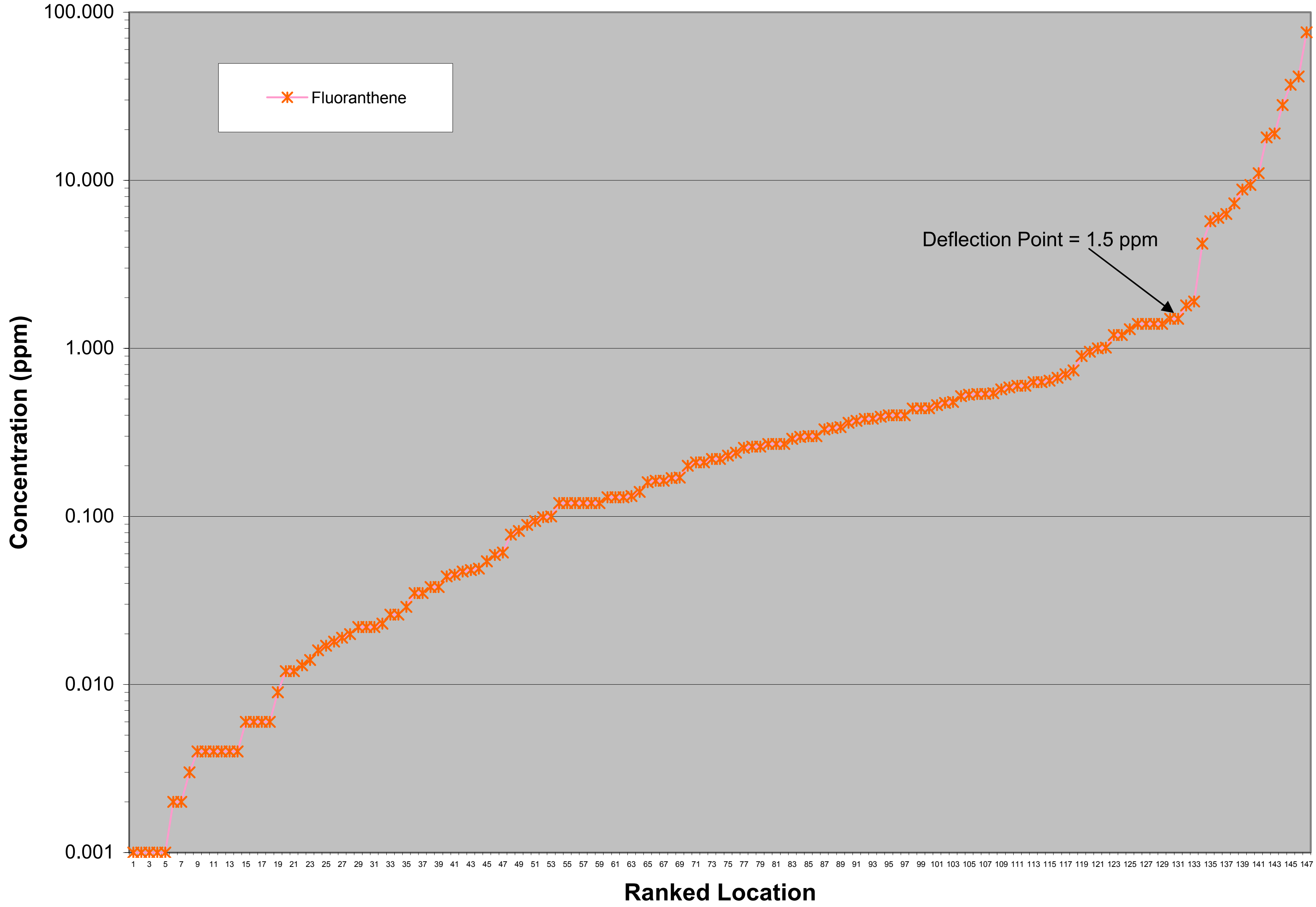


Figure N-27
Indeno(1,2,3-c,d)pyrene Concentrations in Soil

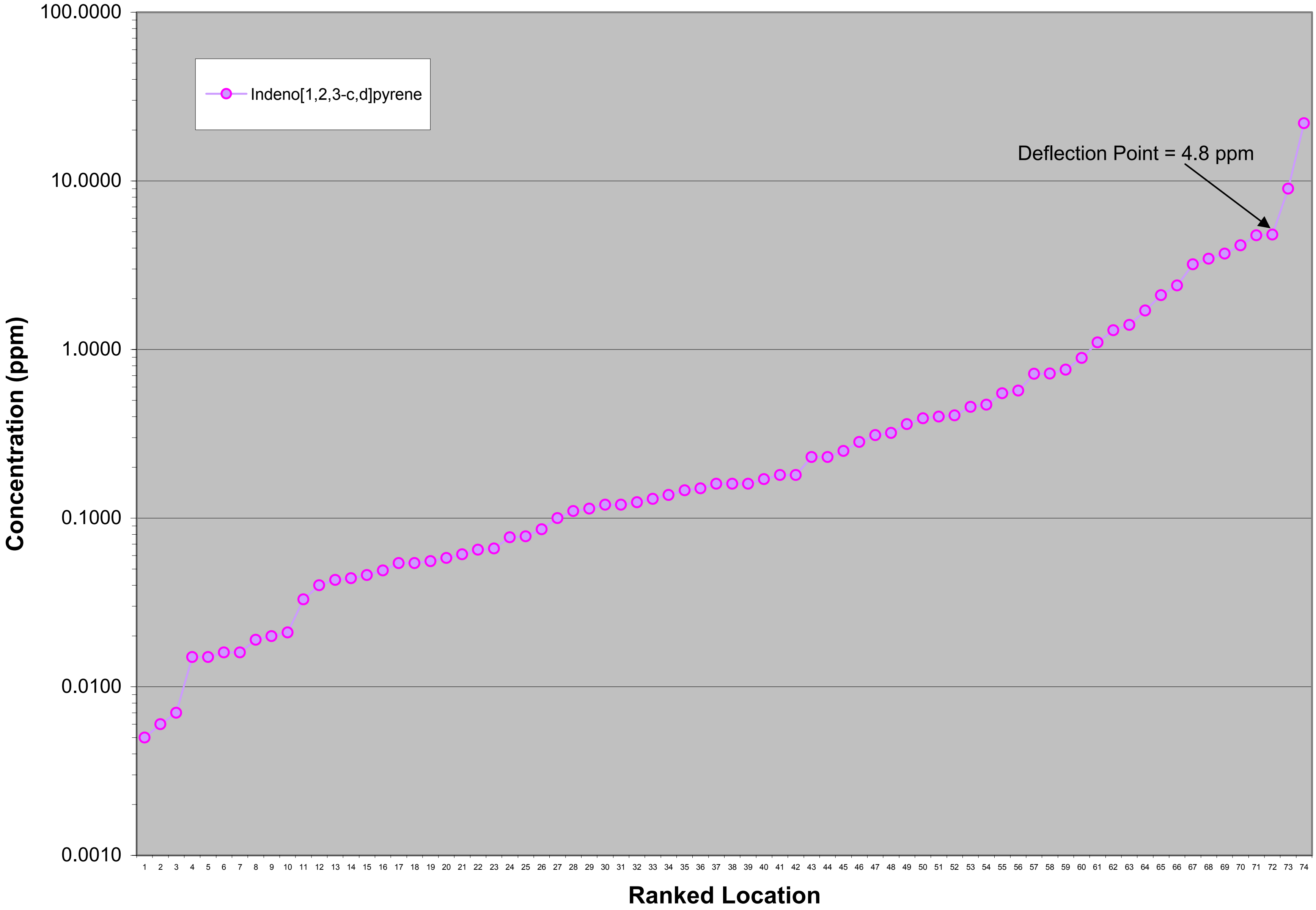


Figure N-28
Naphthalene Concentrations in Soil

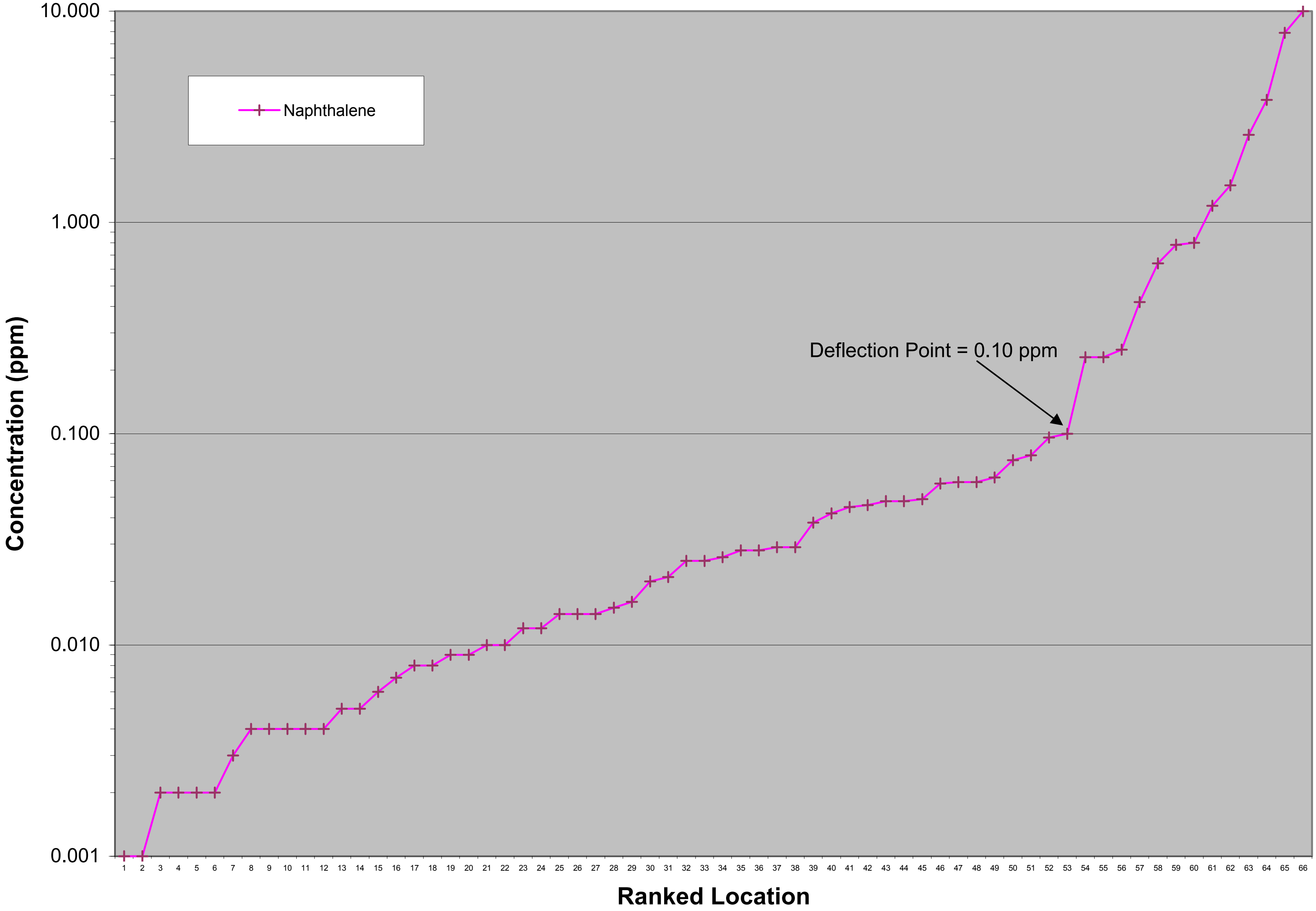


Figure N-29
Phenanthrene Concentrations in Soil

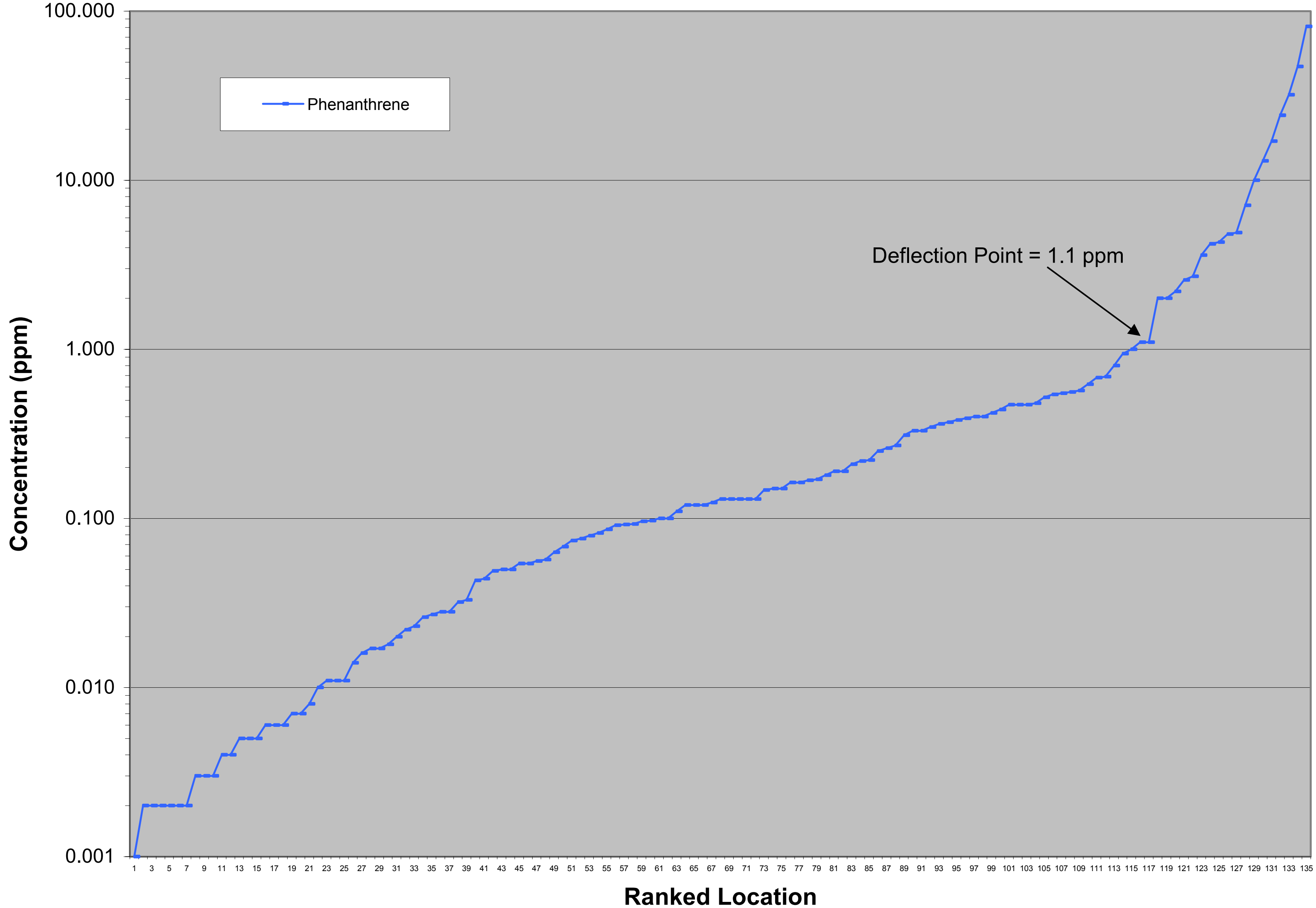
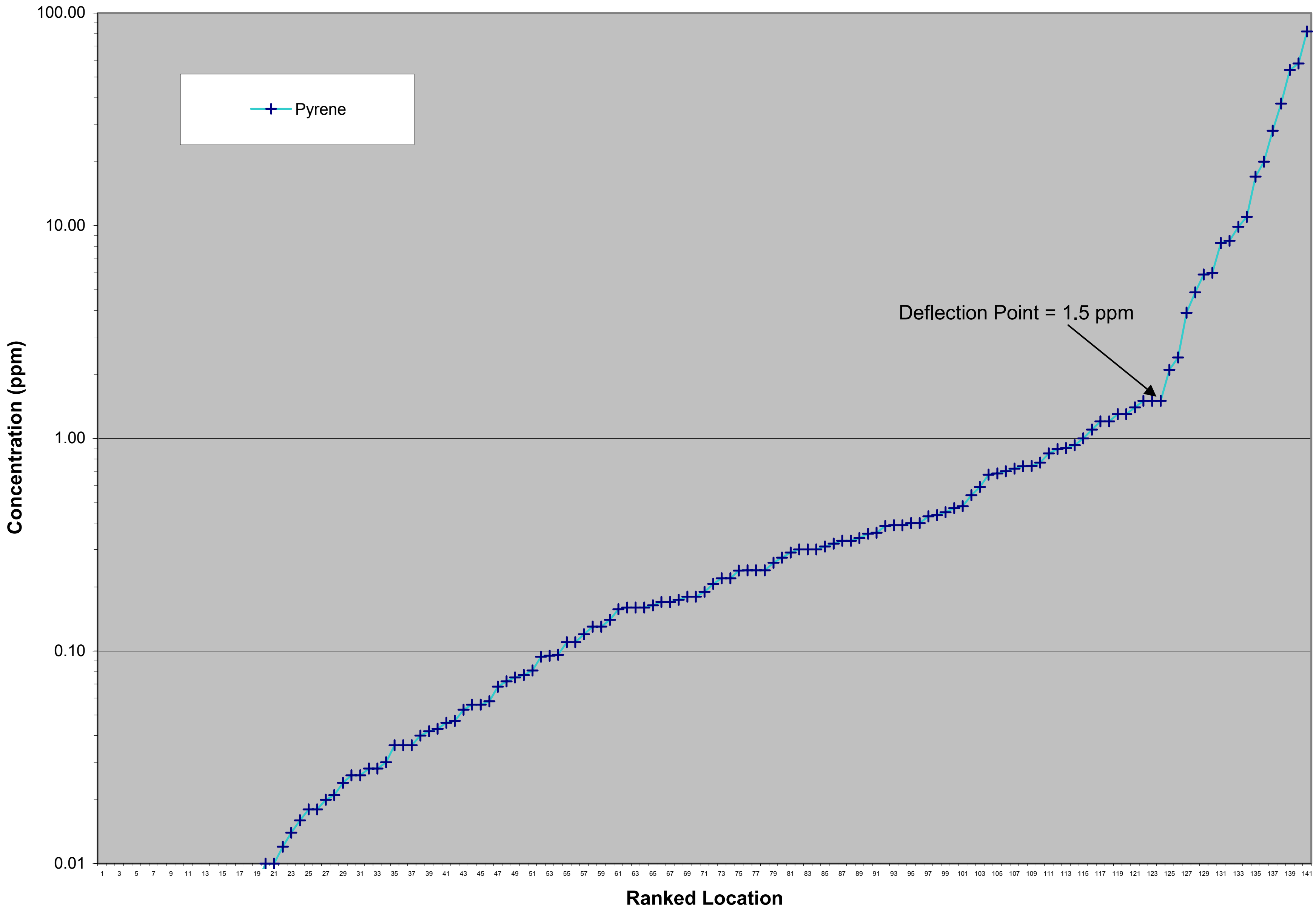


Figure N-30
Pyrene Concentrations in Soil



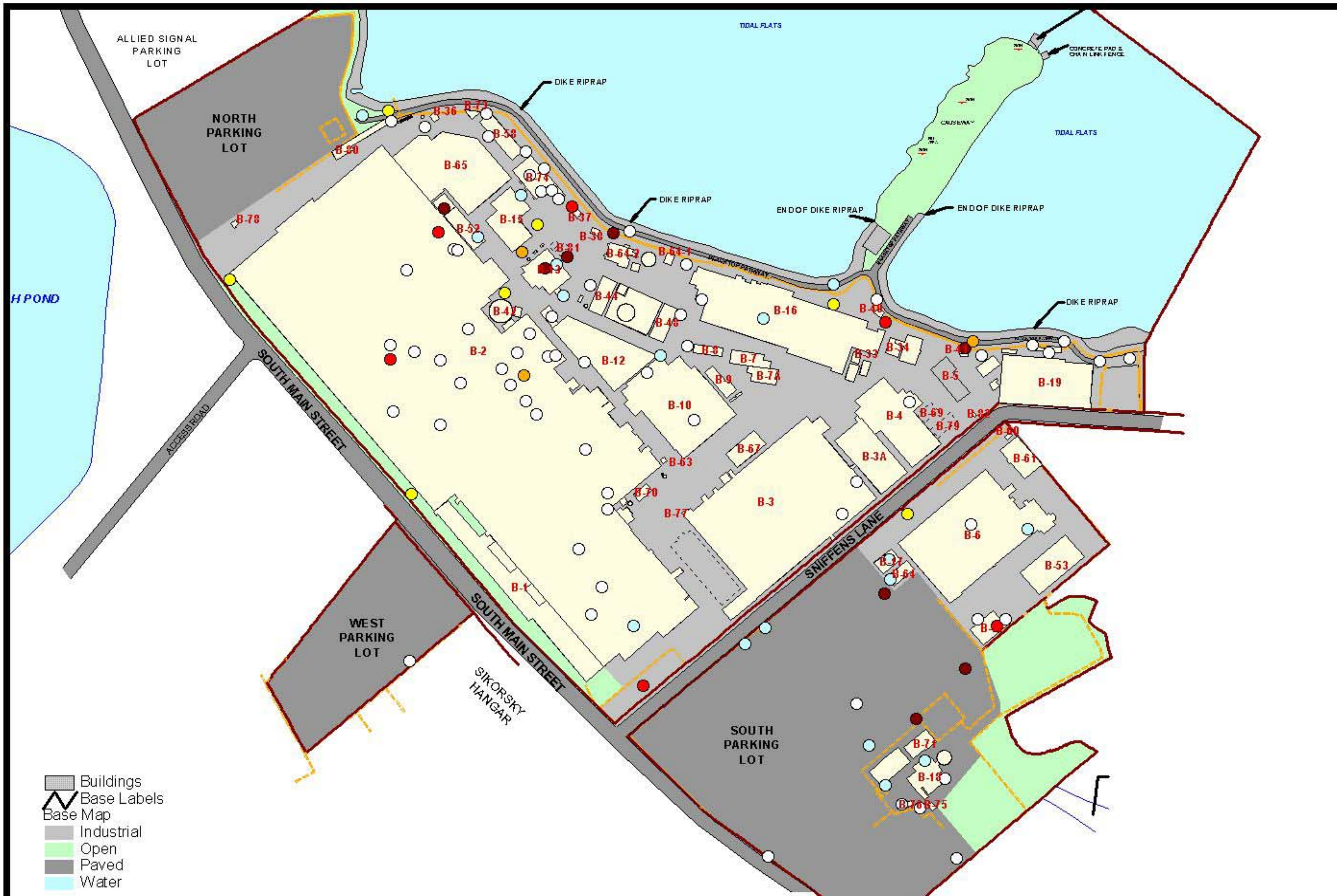


FIGURE Z-31
Maximum Concentrations
of Individual PAHs
Detected in Soil

Stratford Army Engine Plant
Stratford, Connecticut

MACTEC E&C

Figure N-32
Antimony Concentrations in Soil

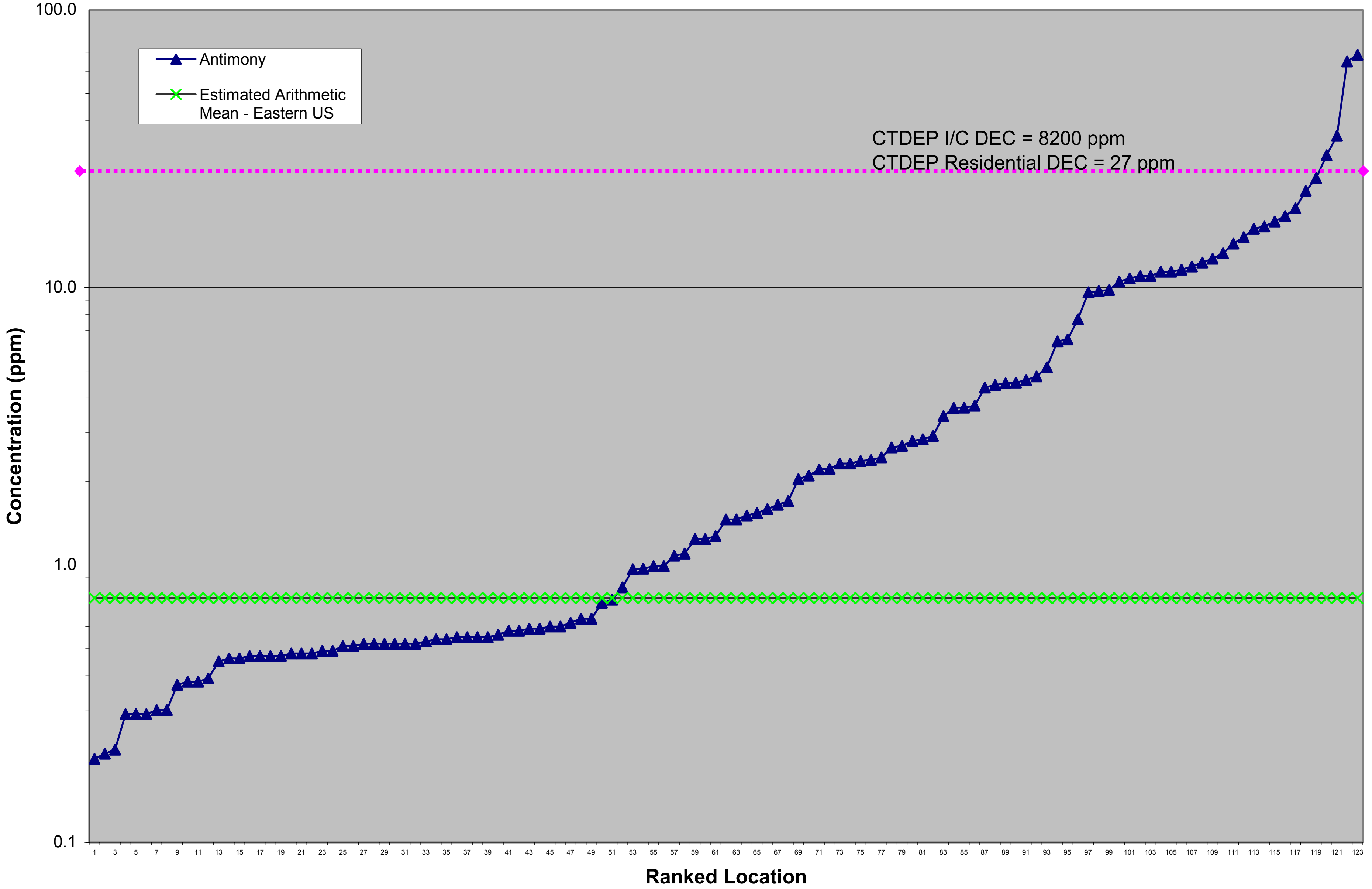


Figure N-33
Arsenic Concentrations in Soil

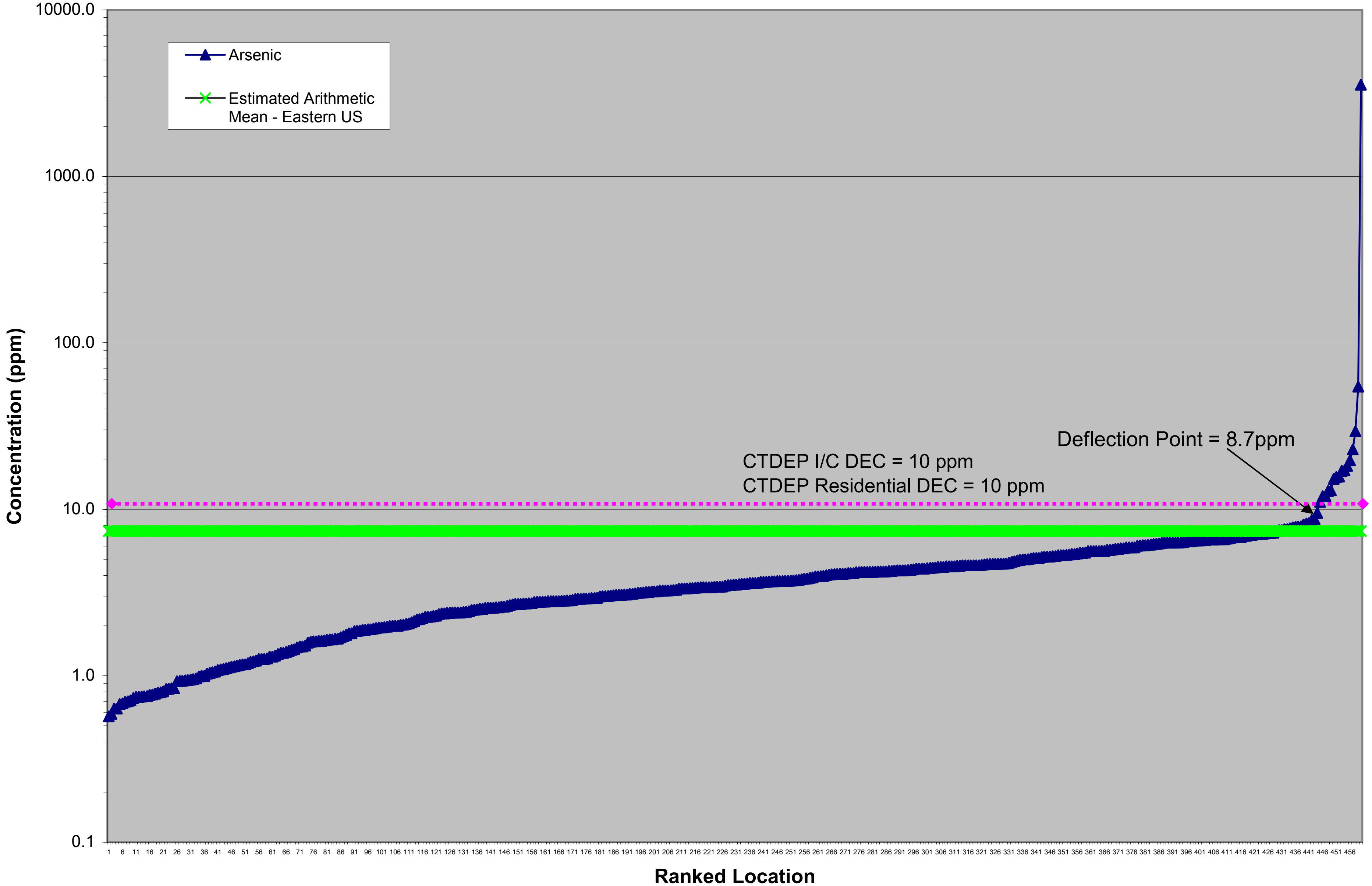


Figure N-34
Barium Concentrations in Soil

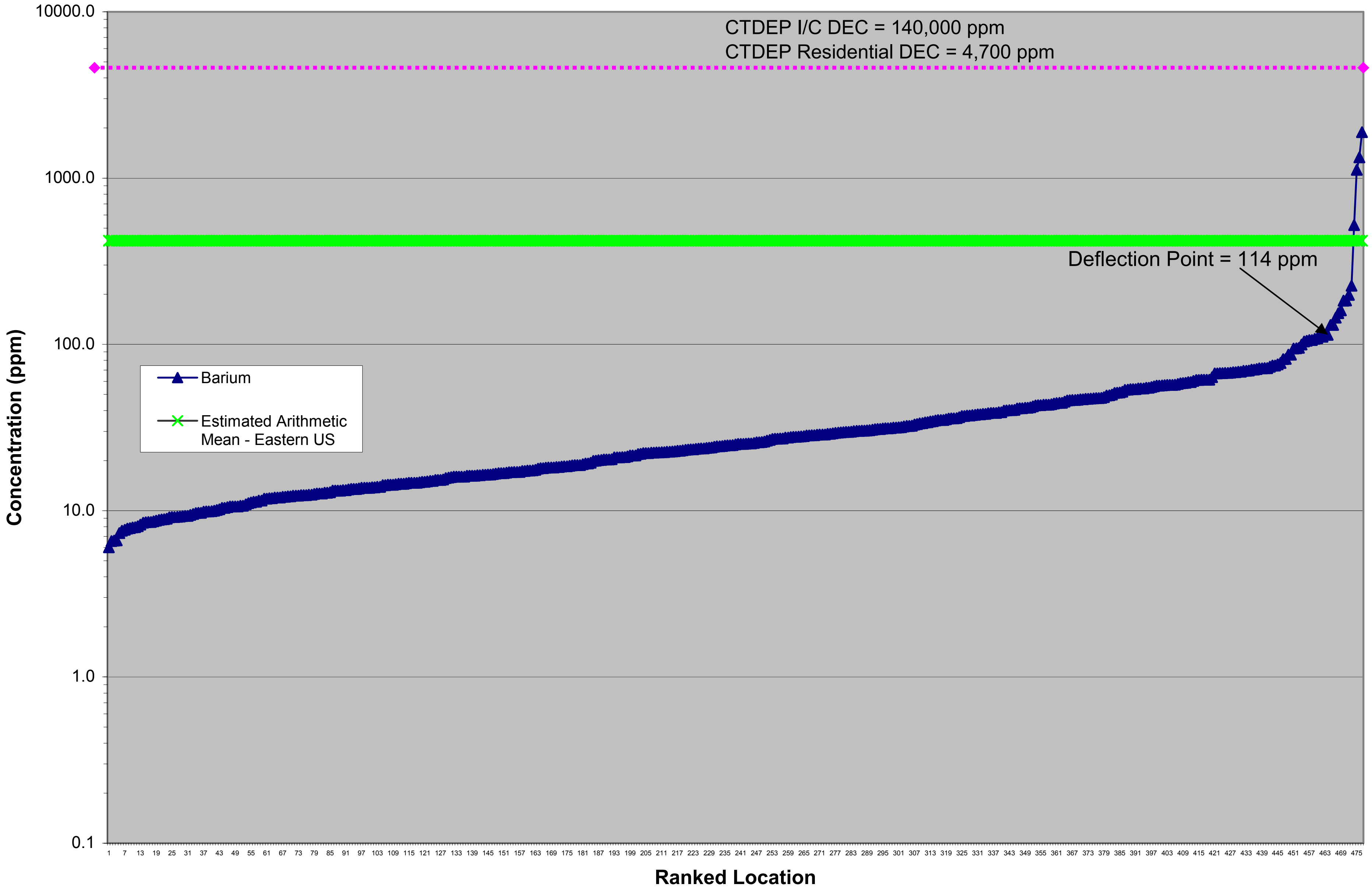
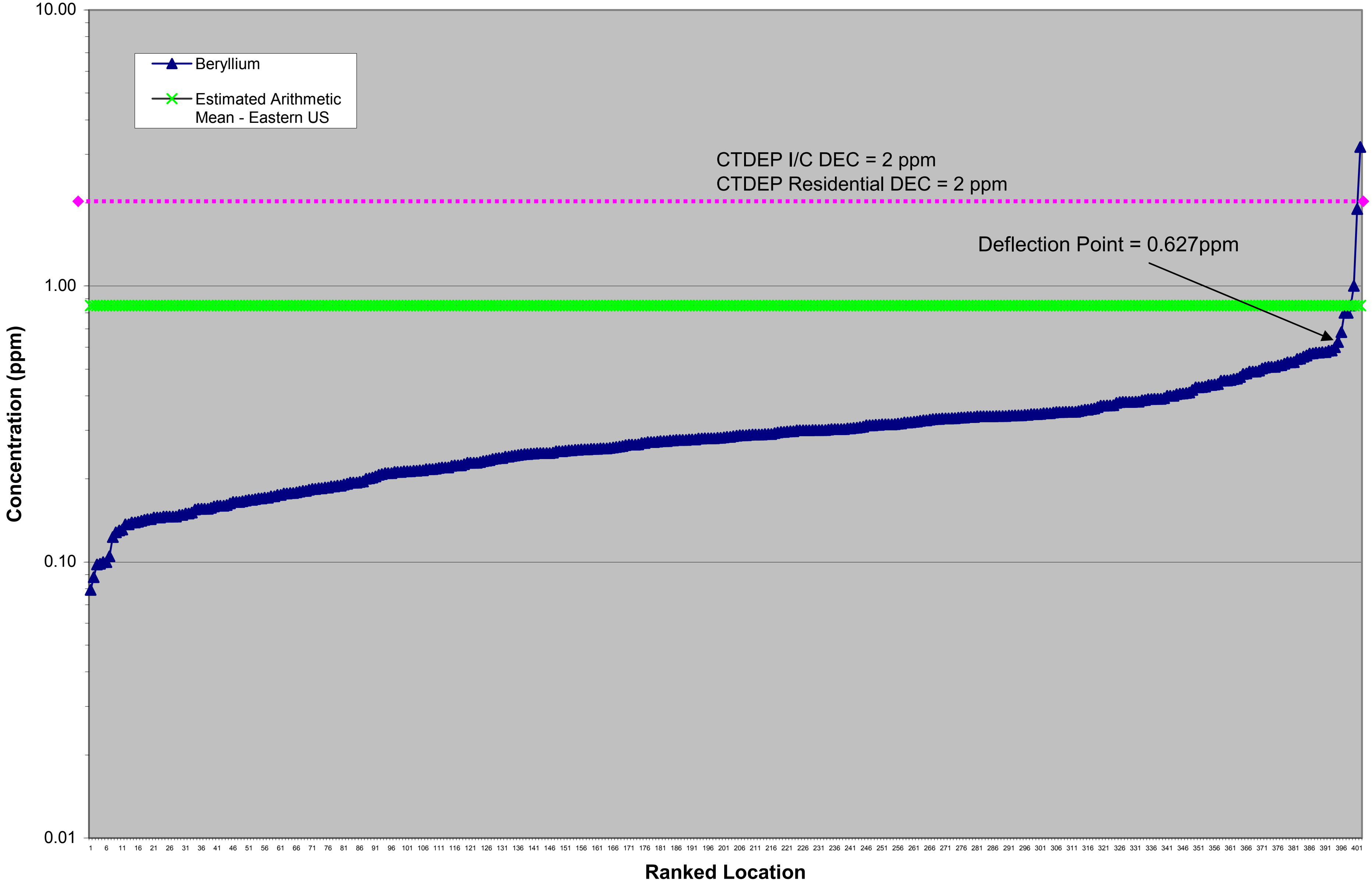


Figure N-35
Beryllium Concentrations in Soil



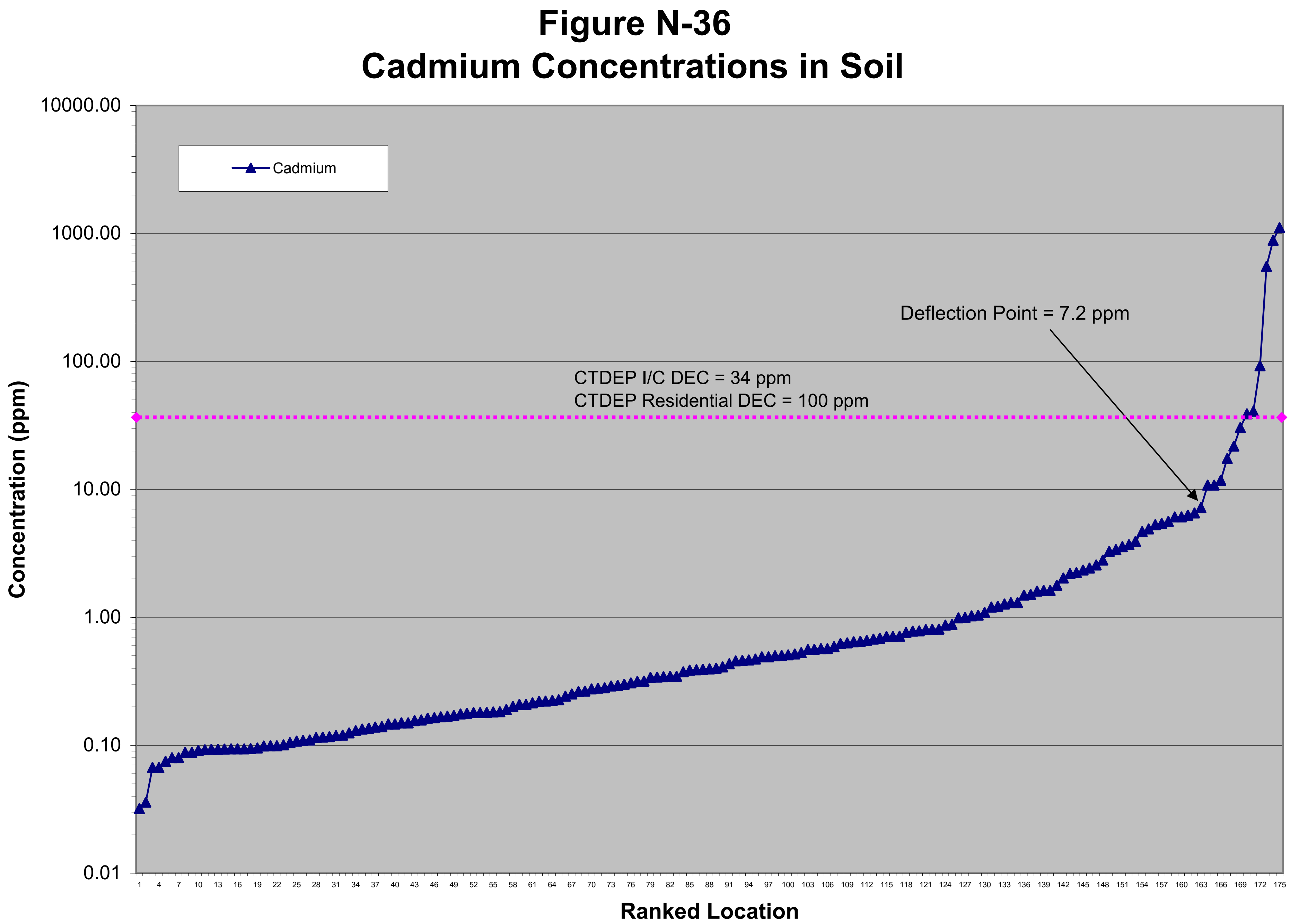


Figure N-36
Cadmium Concentrations in Soil
Cadmium
Deflection Point = 7.2 ppm
CTDEP I/C DEC = 34 ppm
CTDEP Residential DEC = 100 ppm
Concentration (ppm)
Ranked Location
10000.00
1000.00
100.00
10.00
1.00
0.10
0.01

Figure N-37
Chromium (Total) Concentrations in Soil

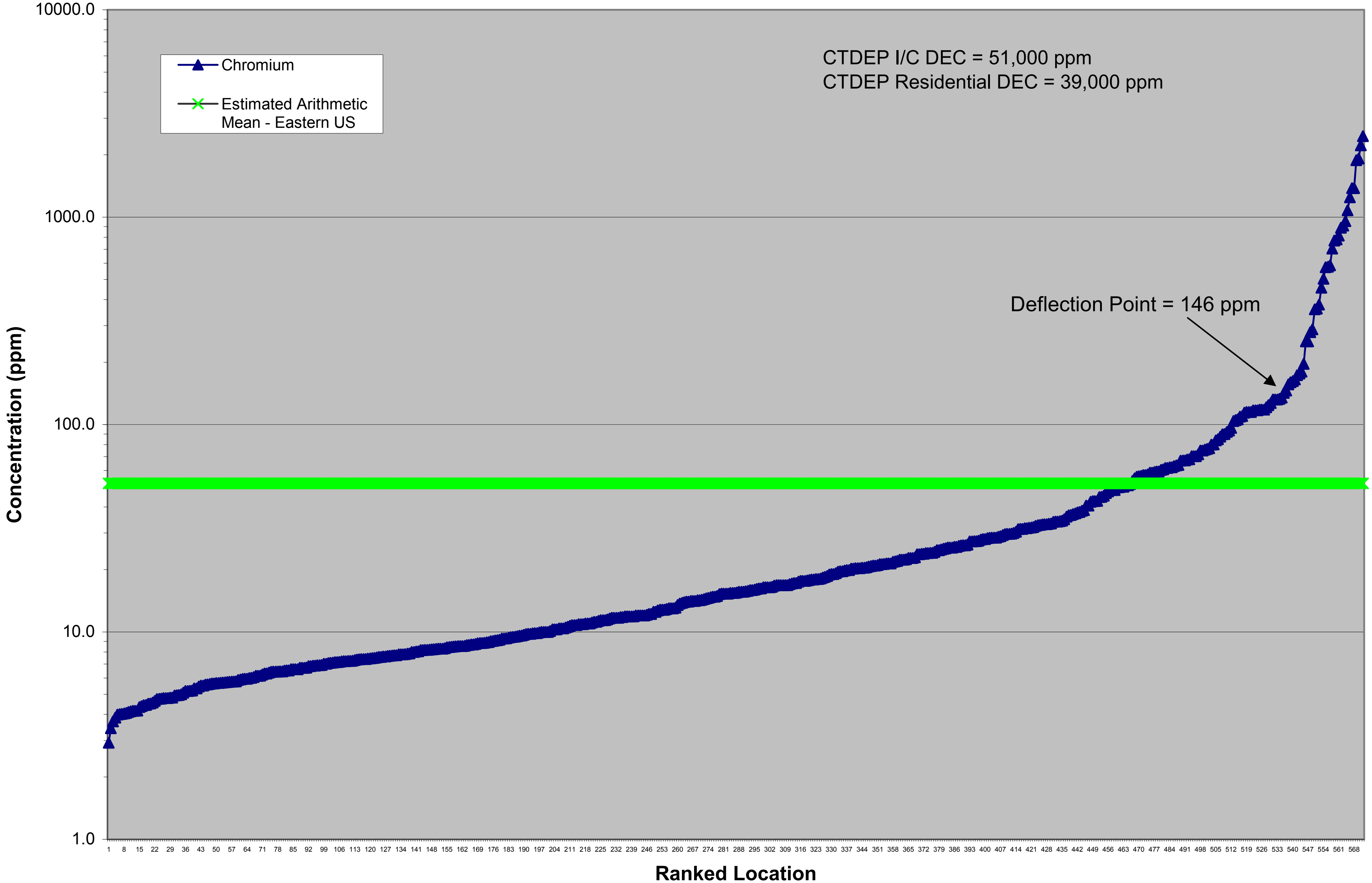


Figure N-38
Copper Concentrations in Soil

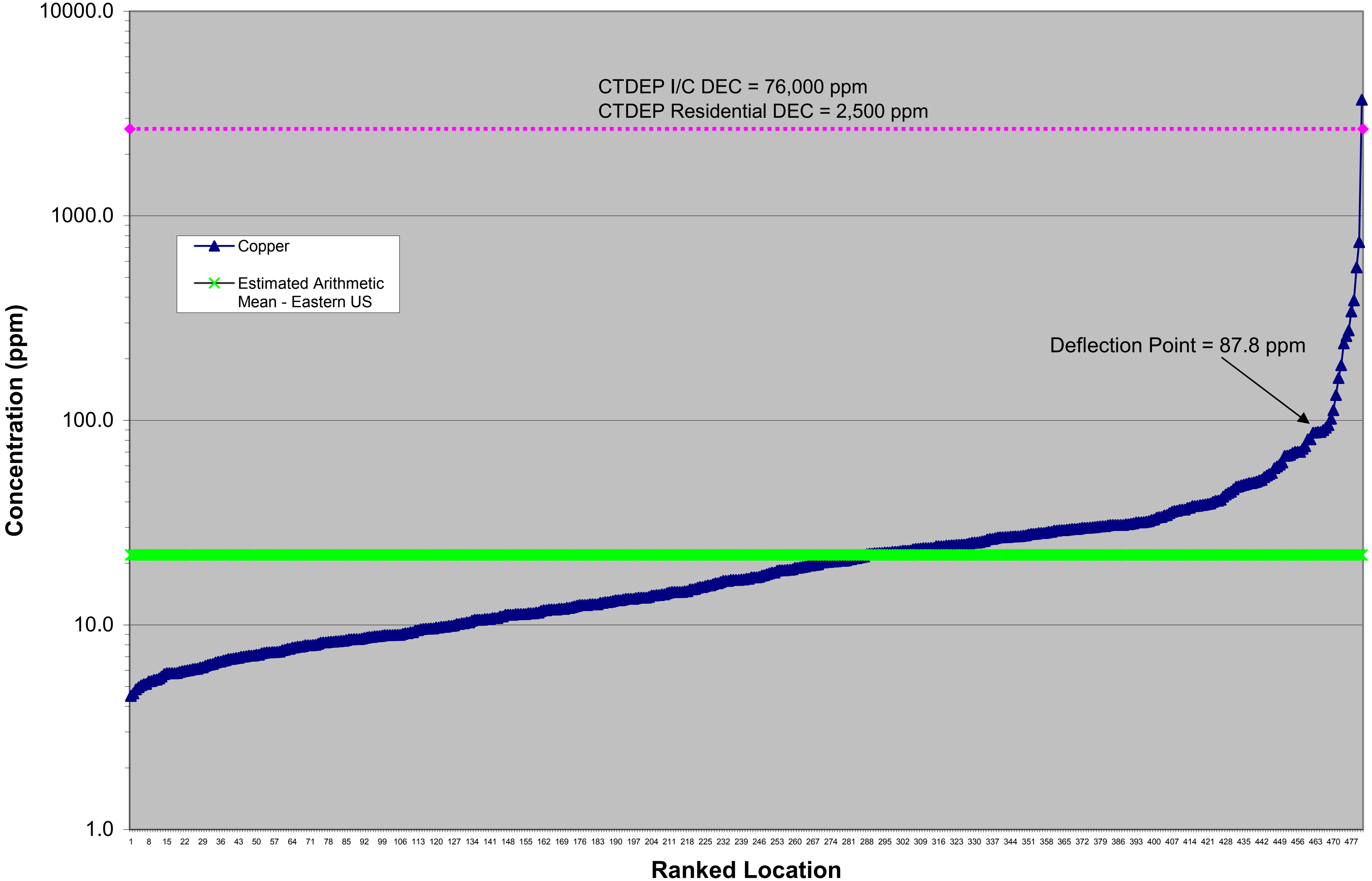


Figure N-39
Lead Concentrations in Soil

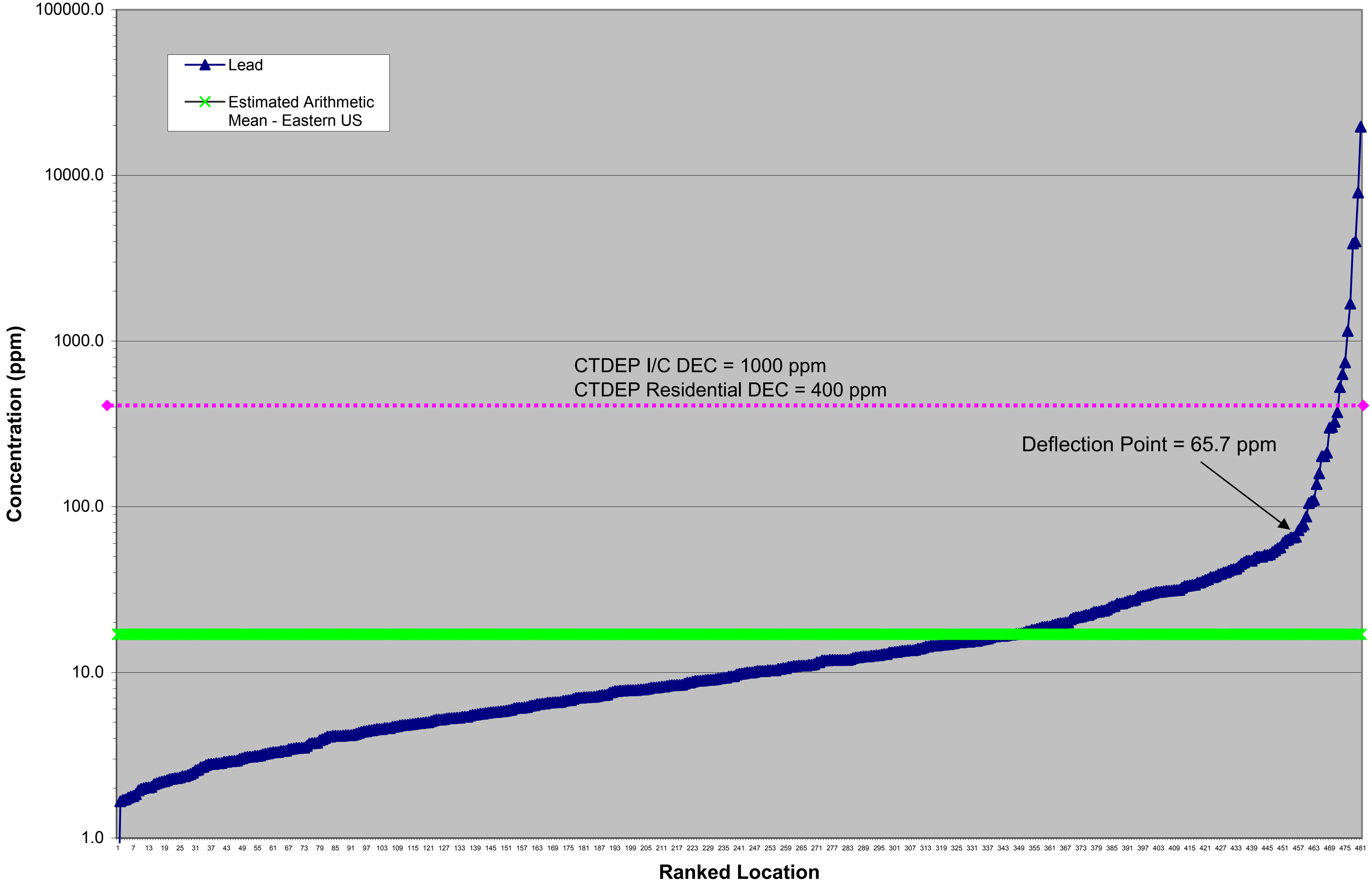


Figure N-40
Mercury Concentrations in Soil

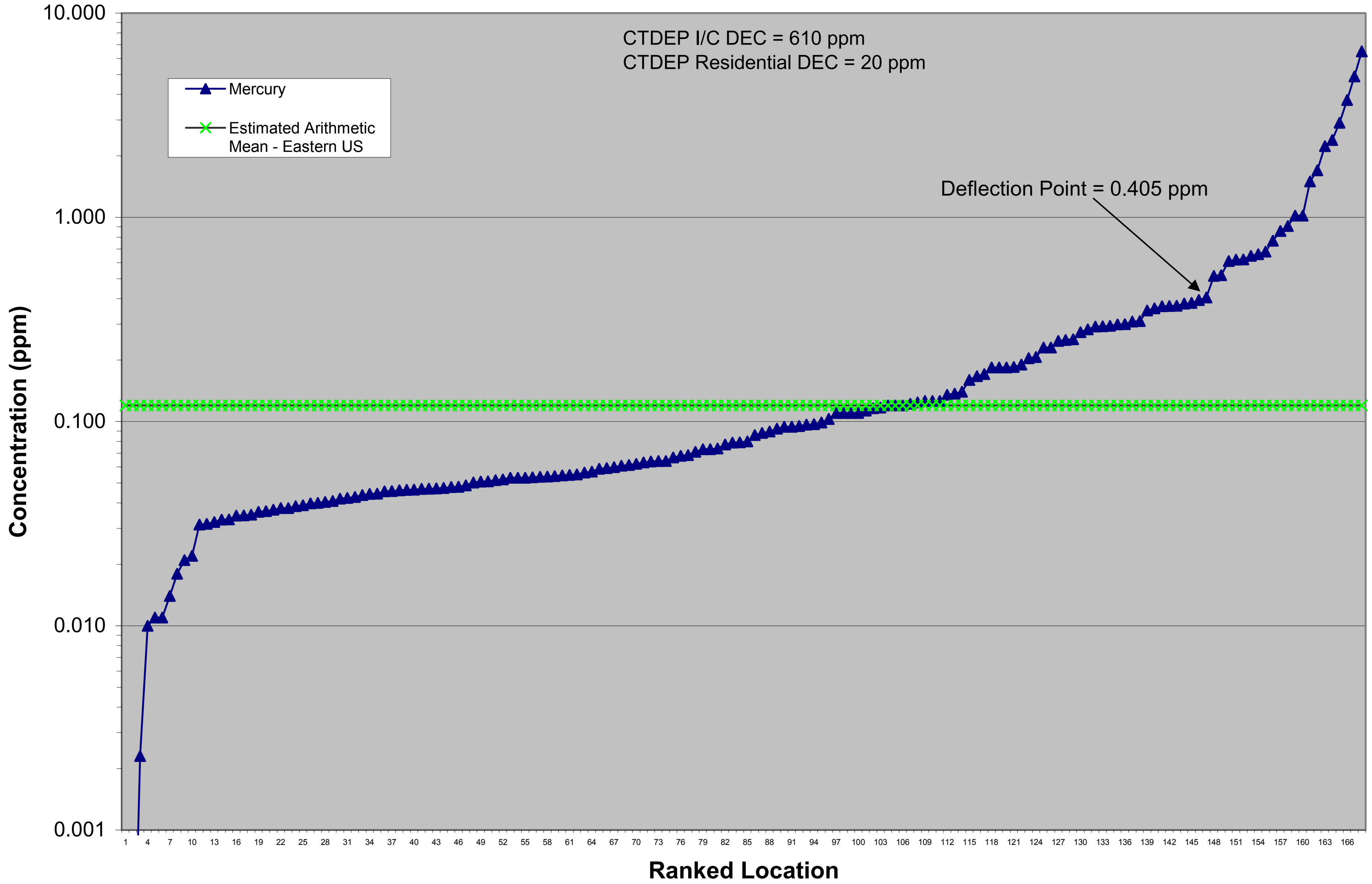


Figure N-41
Nickel Concentrations in Soil

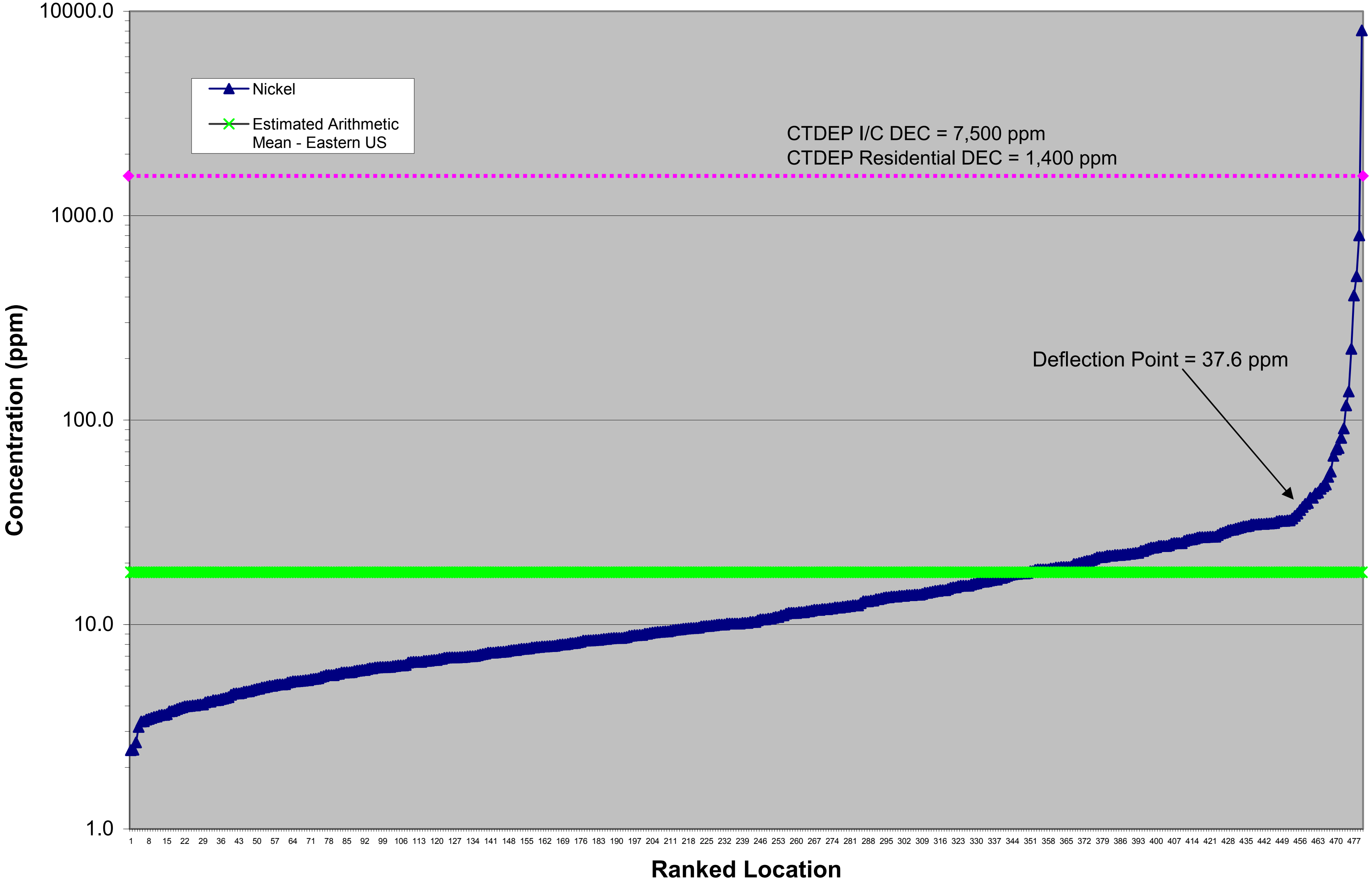


Figure N-42
Selenium Concentrations in Soil

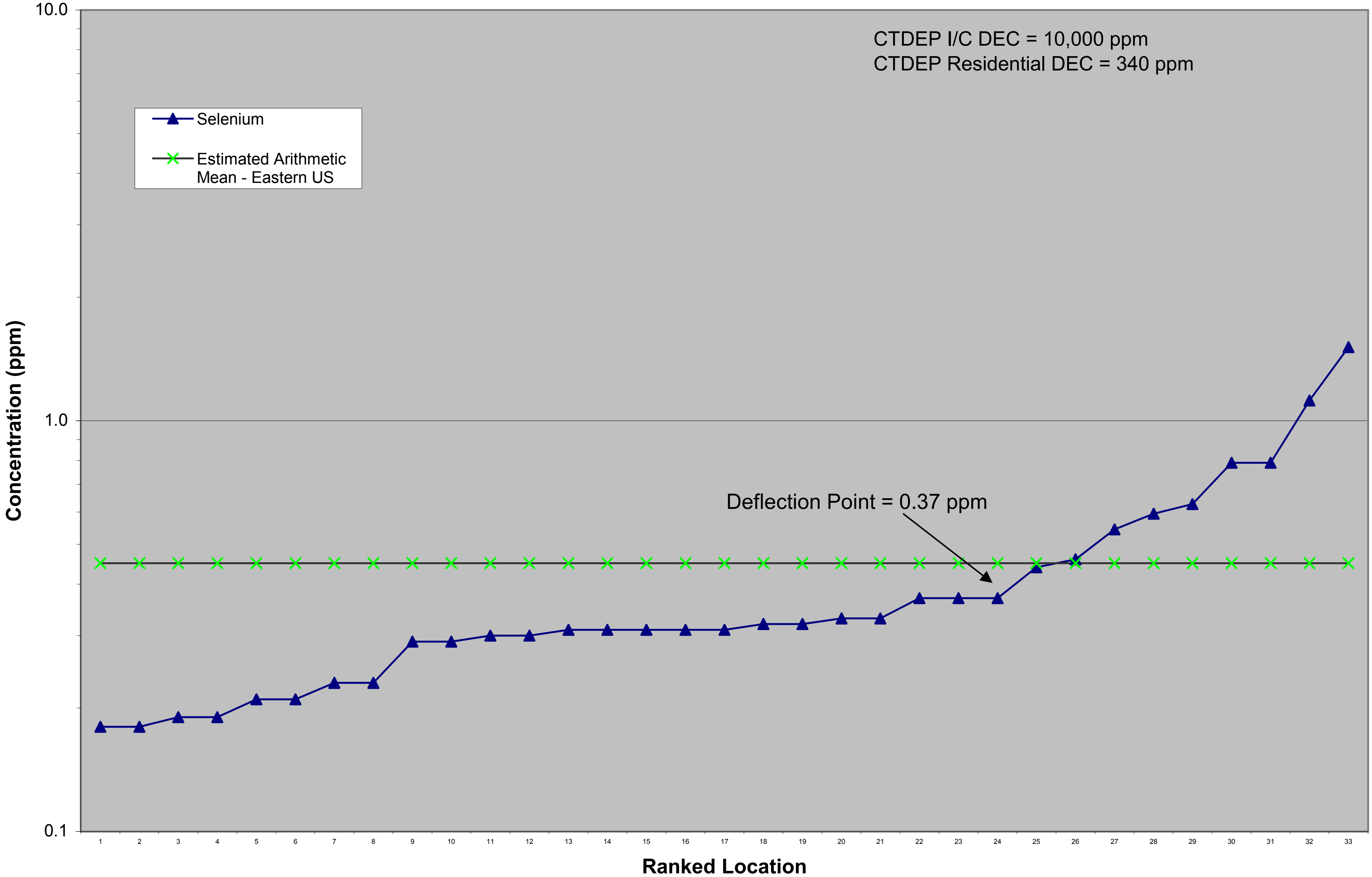


Figure N-43
Silver Concentrations in Soil

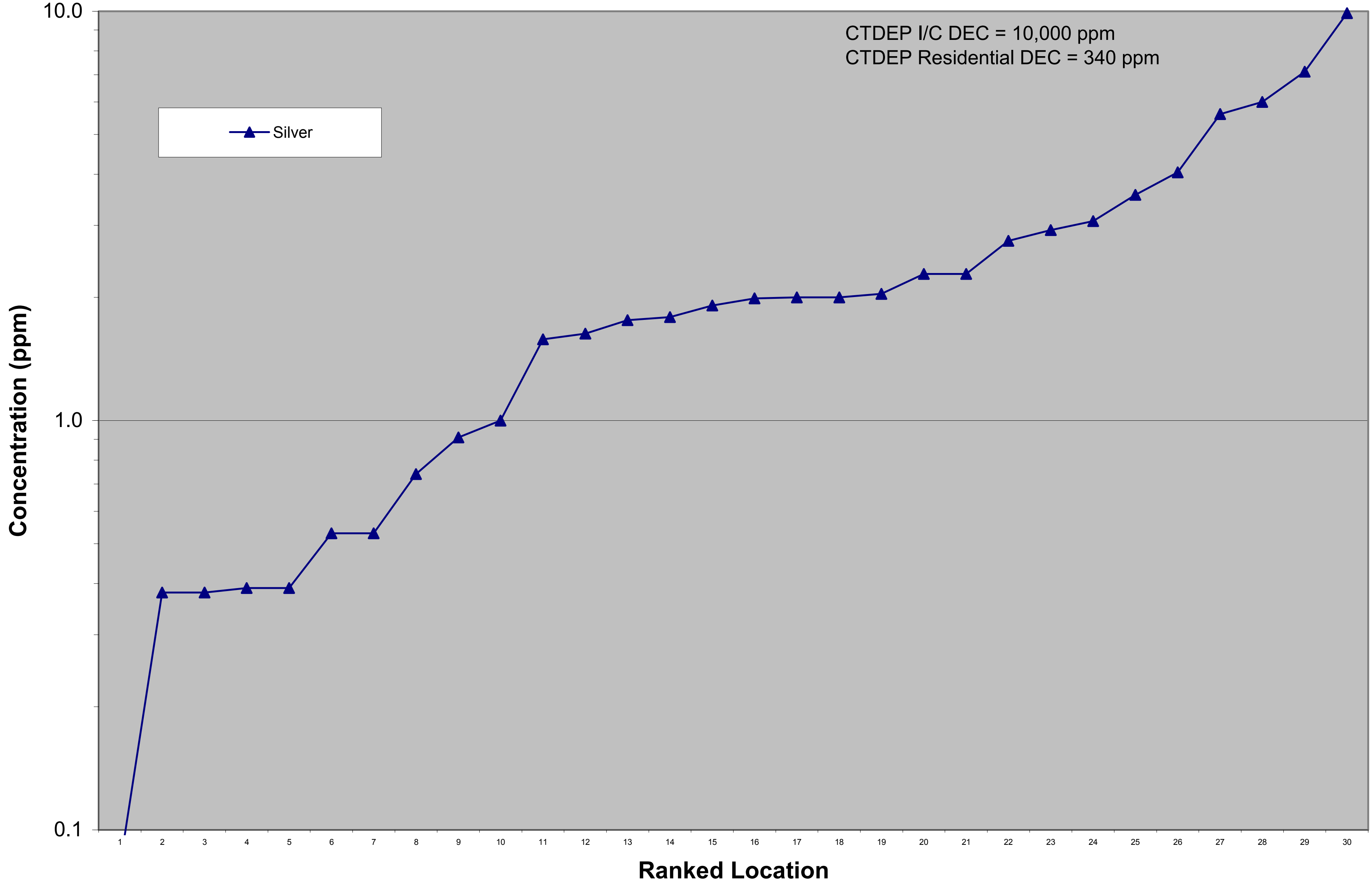


Figure N-44
Thallium Concentrations in Soil

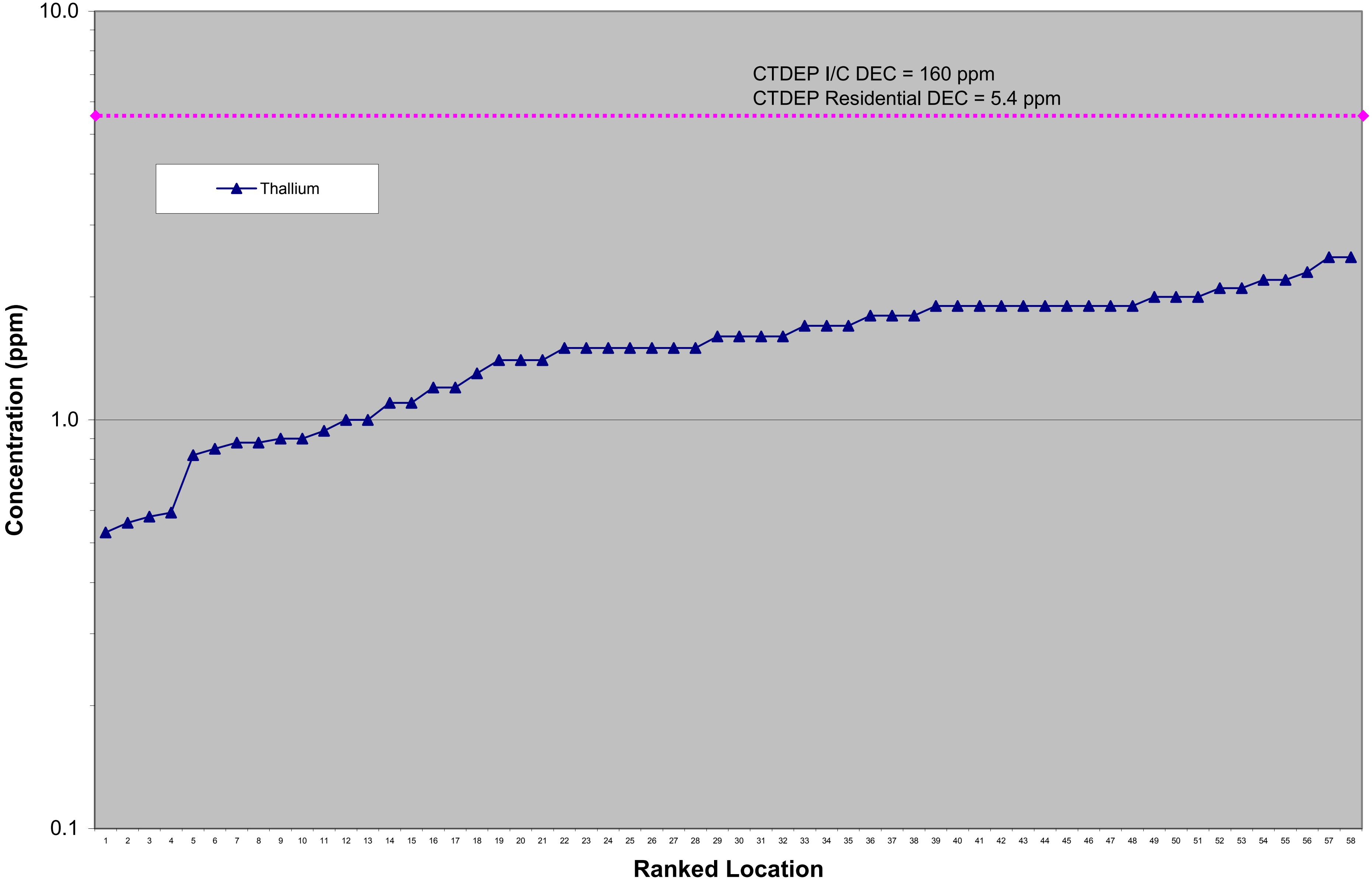


Figure N-45
Vanadium Concentrations in Soil

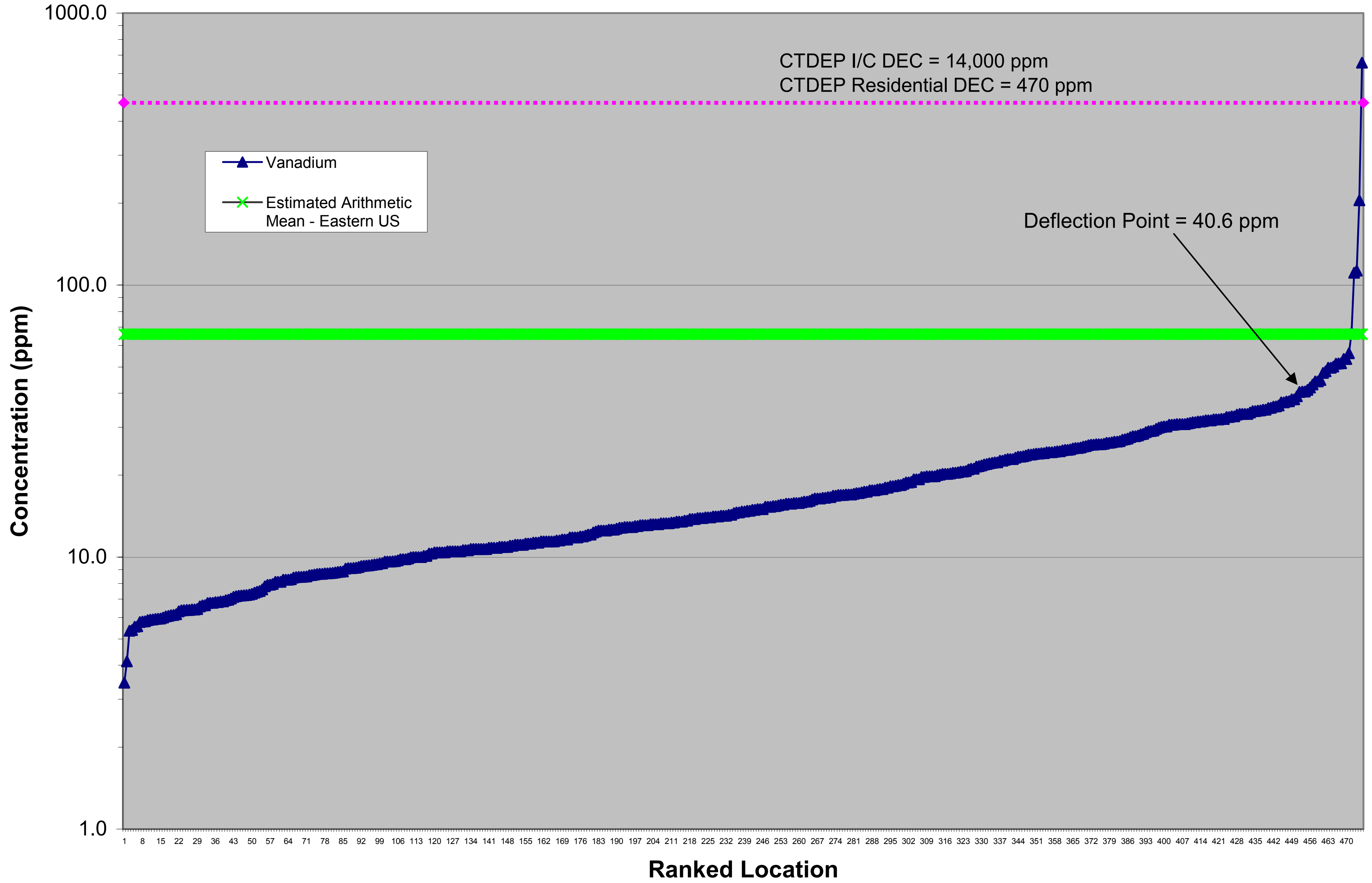


Figure N-46
Zinc Concentrations in Soil

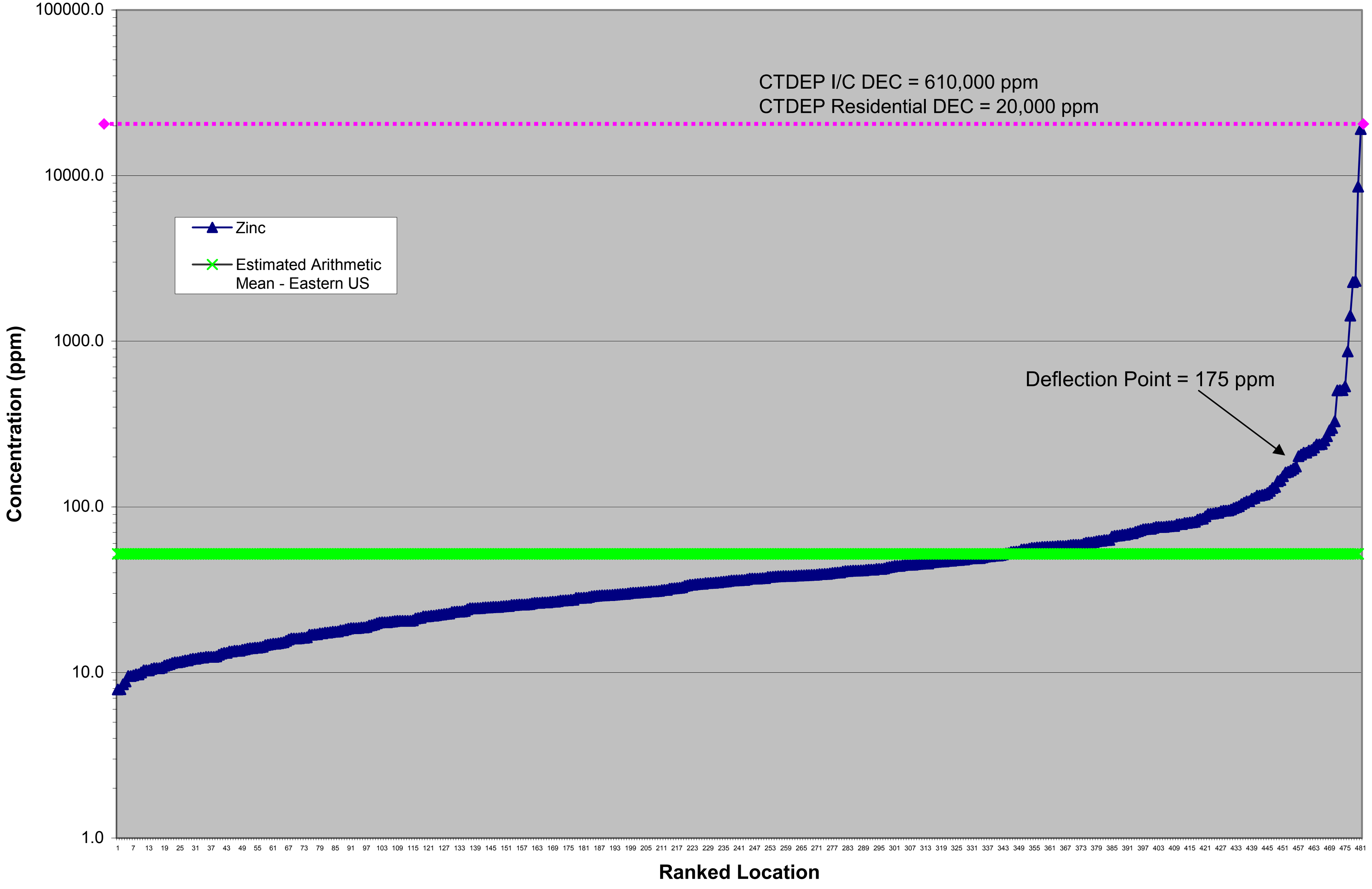


Figure N-47
TPH Concentrations in Soil

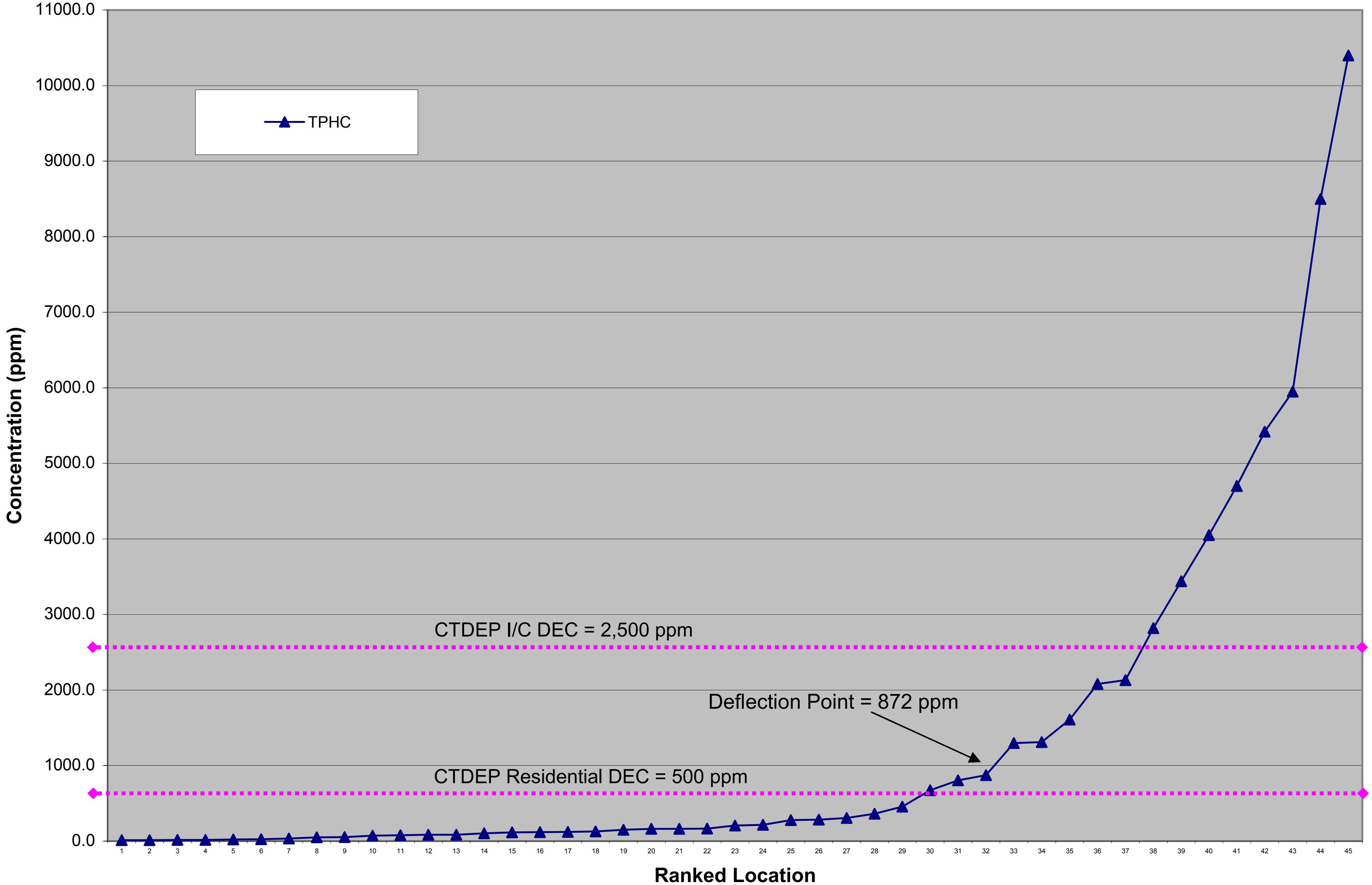


Figure N-48
Antimony Concentrations in Groundwater

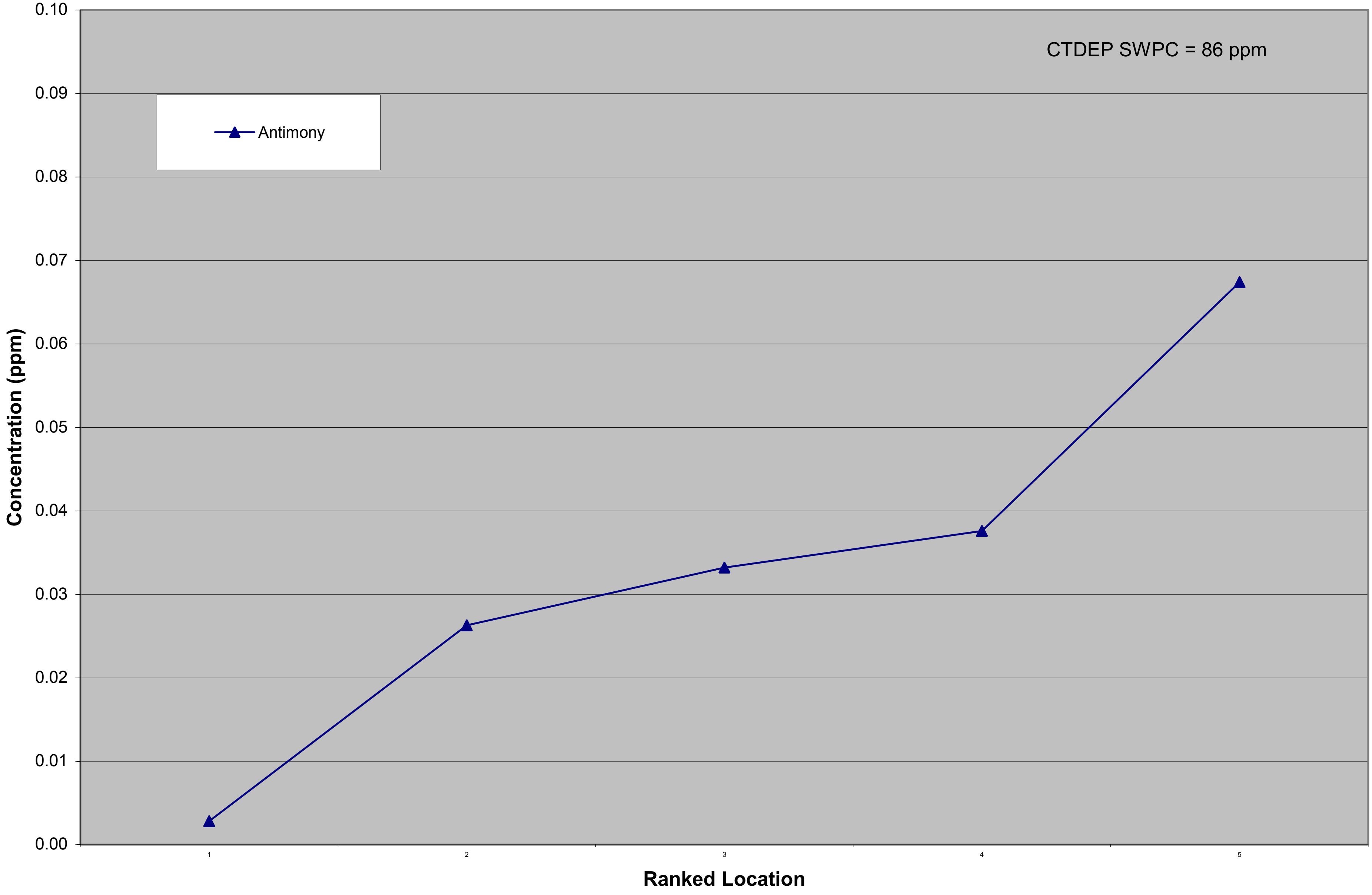


Figure N-49
Arsenic Concentrations in Groundwater

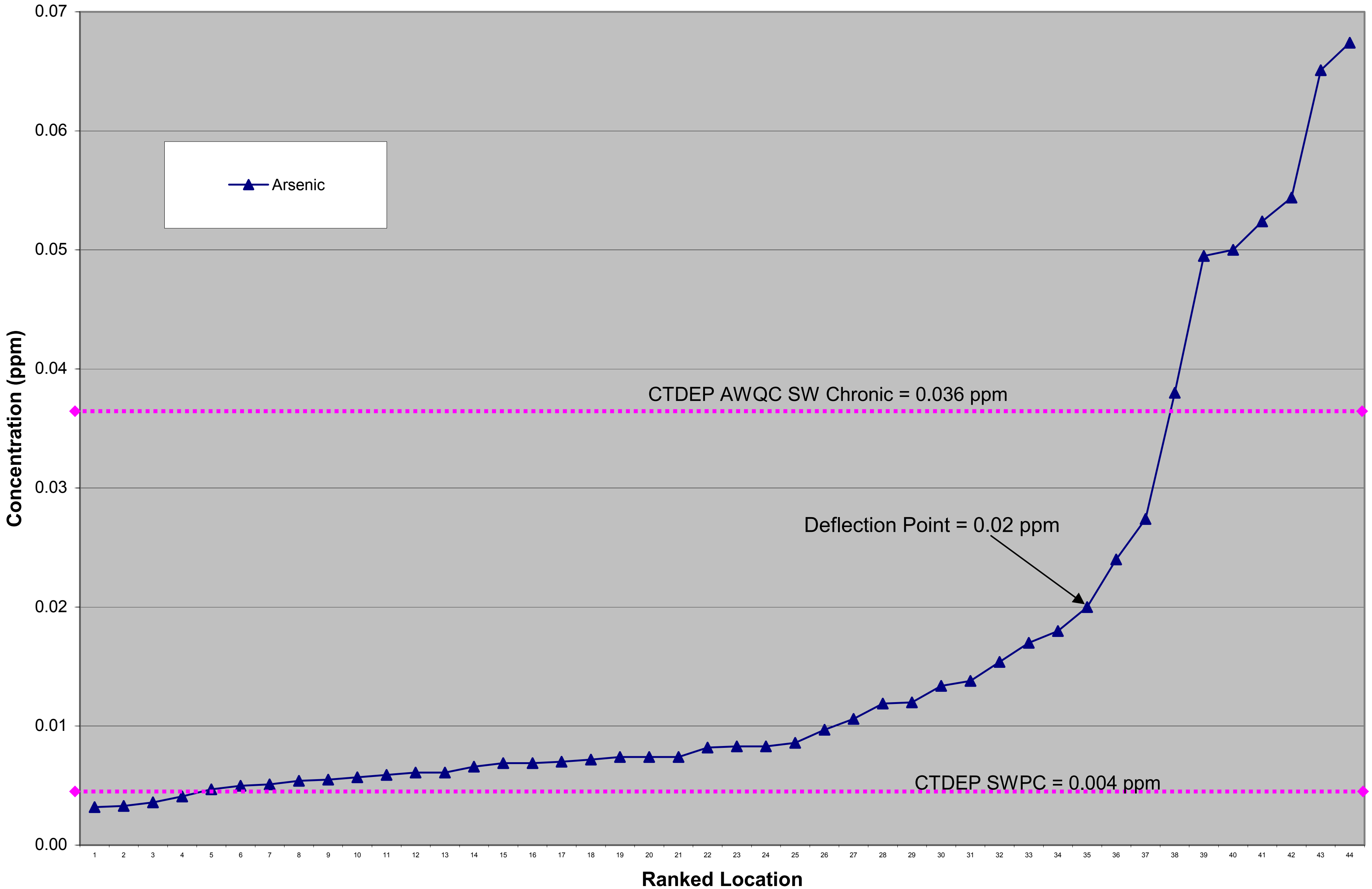


Figure N-50
Barium Concentrations in Groundwater

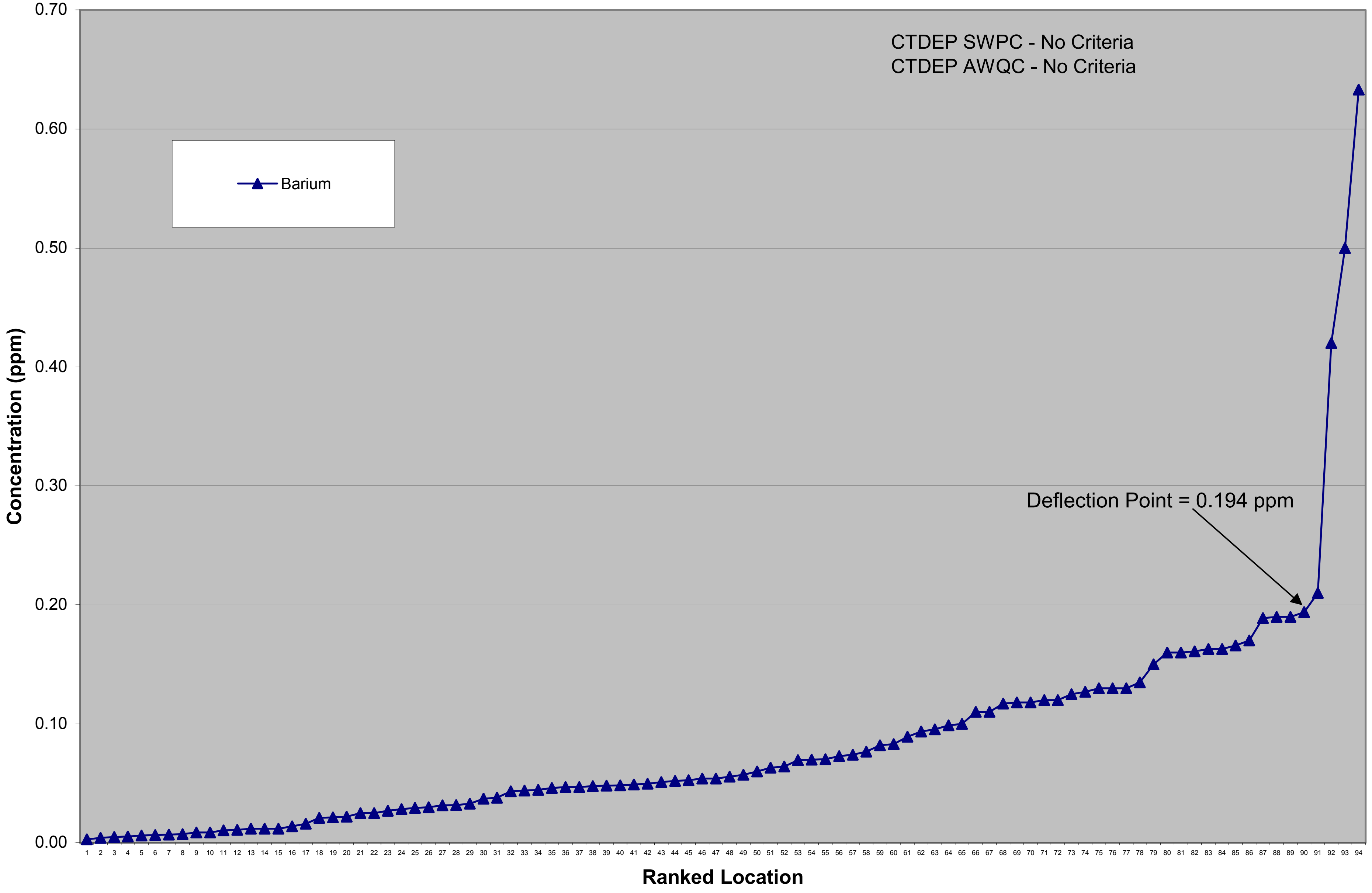


Figure N-51
Beryllium Concentrations in Groundwater

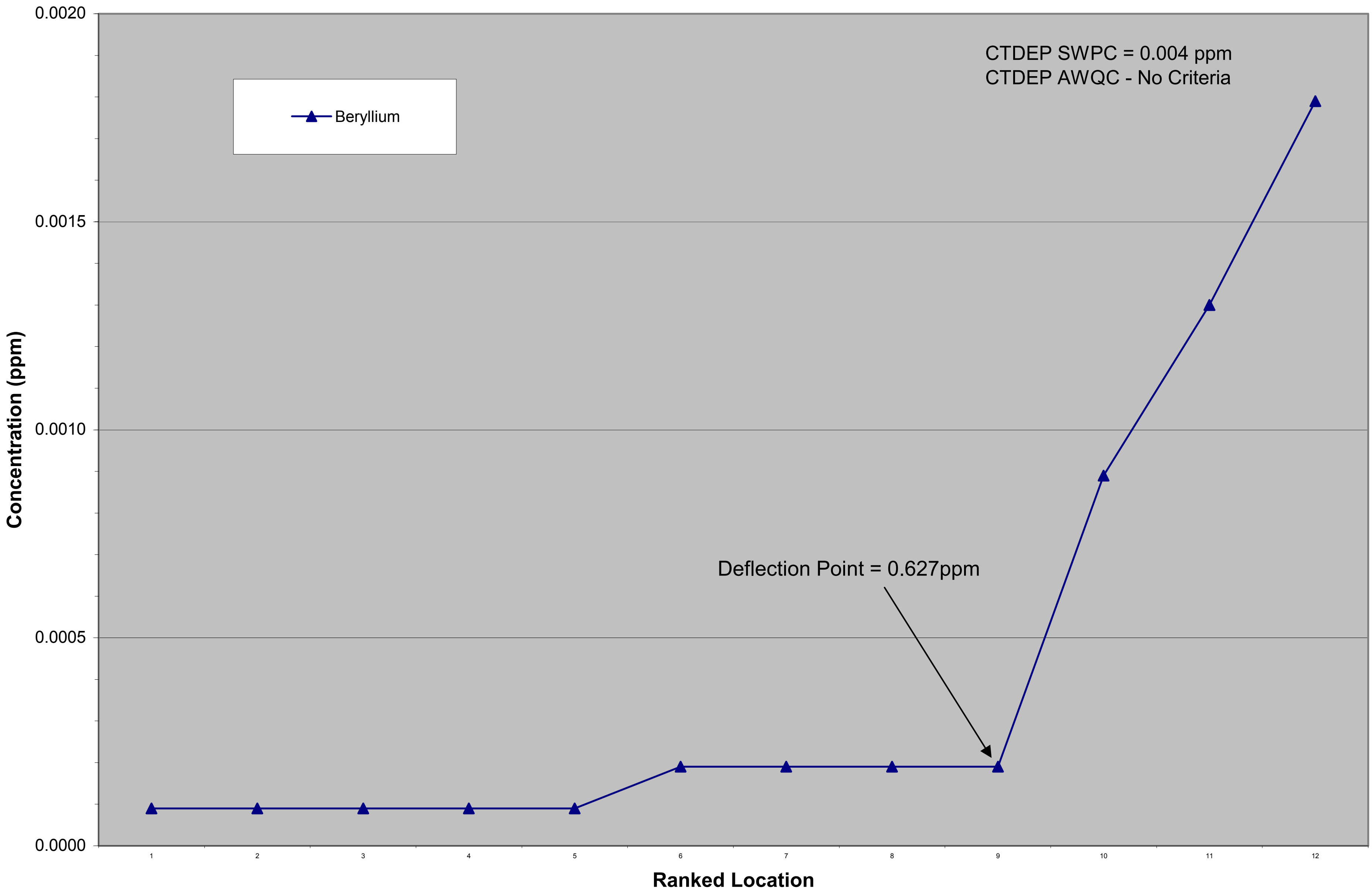


Figure N-52
Cadmium Concentrations in Groundwater

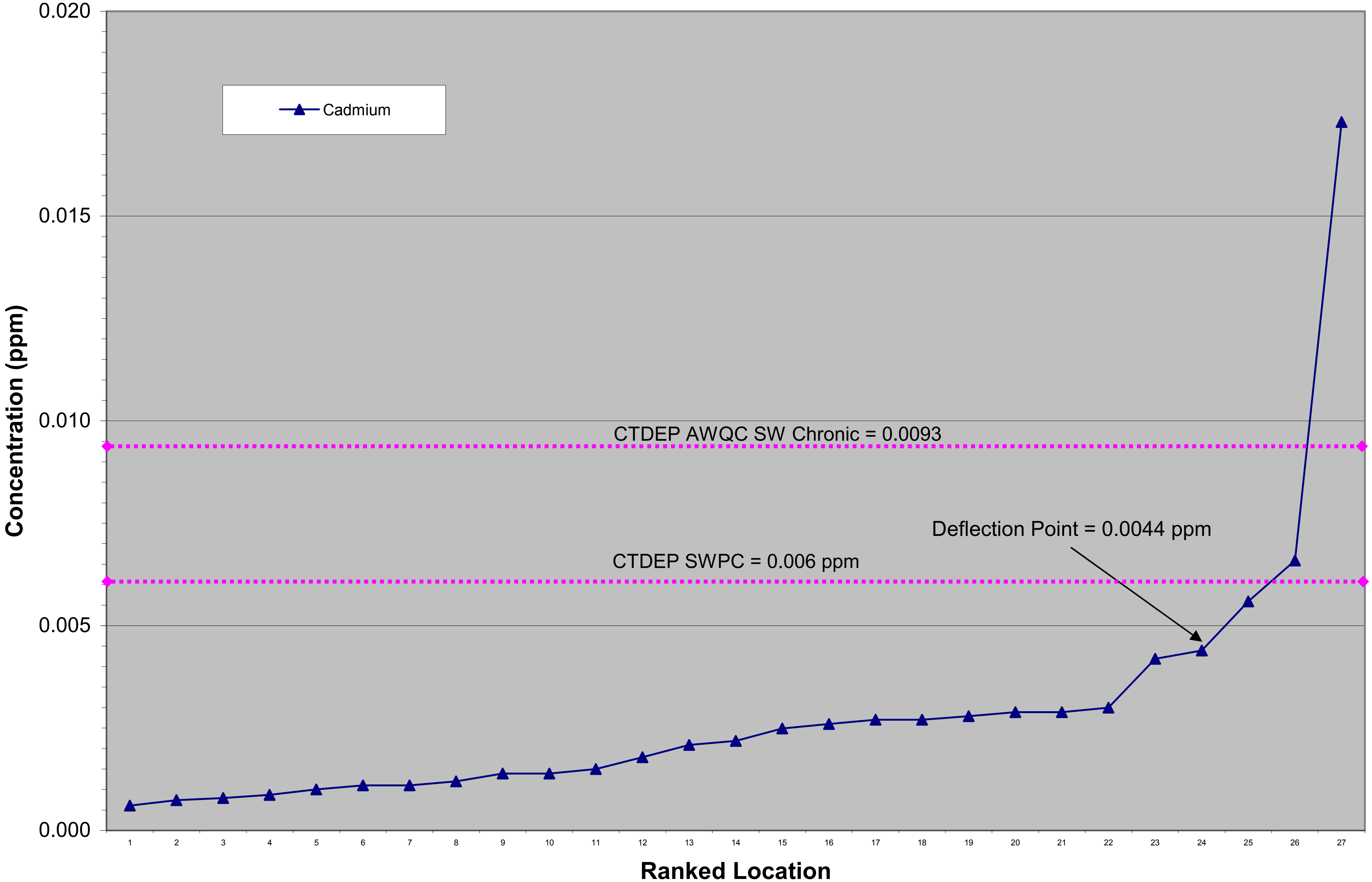


Figure N-53
Chromium (Total) Concentrations in Groundwater

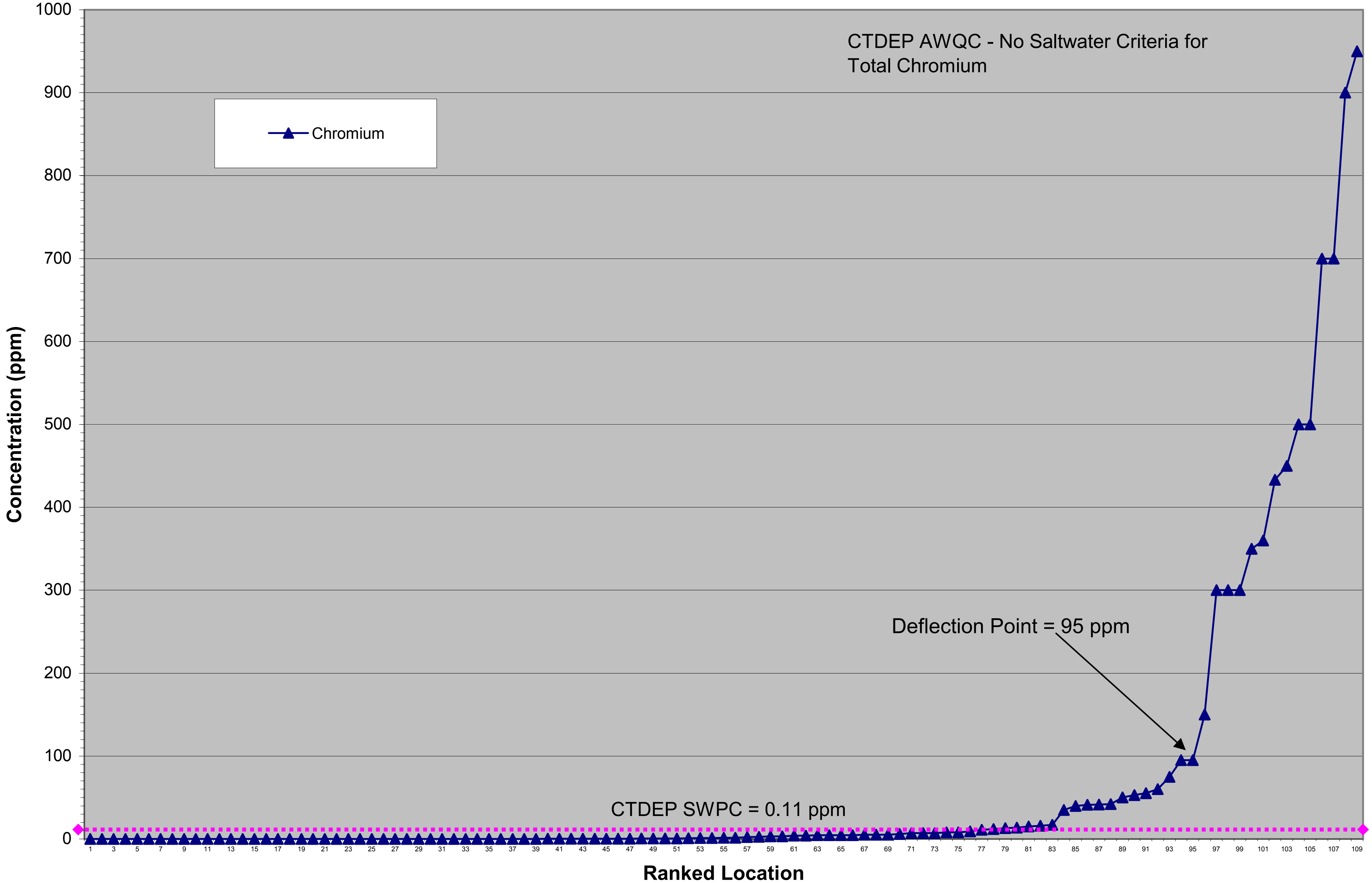


Figure N-54
Copper Concentrations in Groundwater

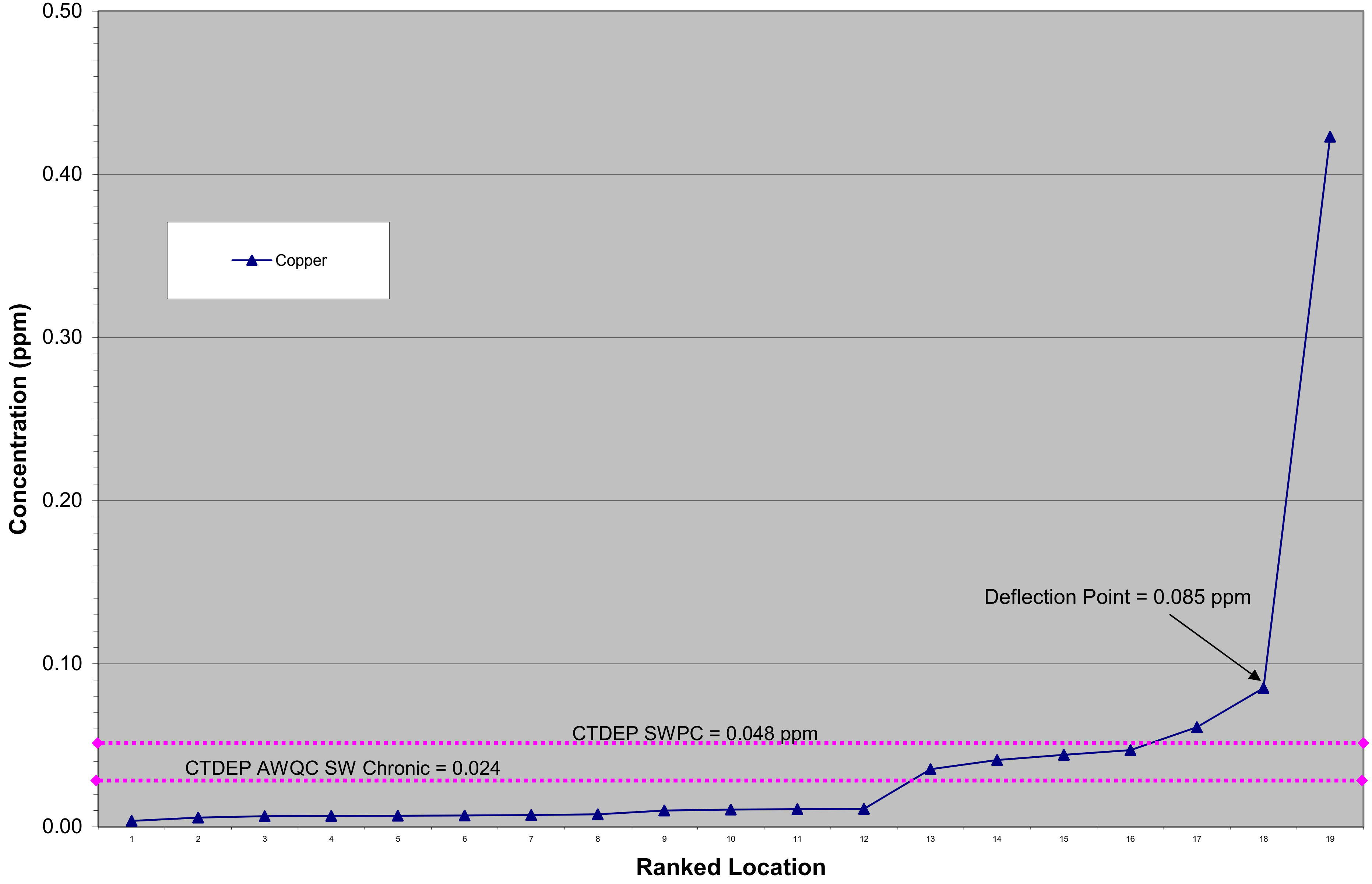


Figure N-55
Lead Concentrations in Groundwater

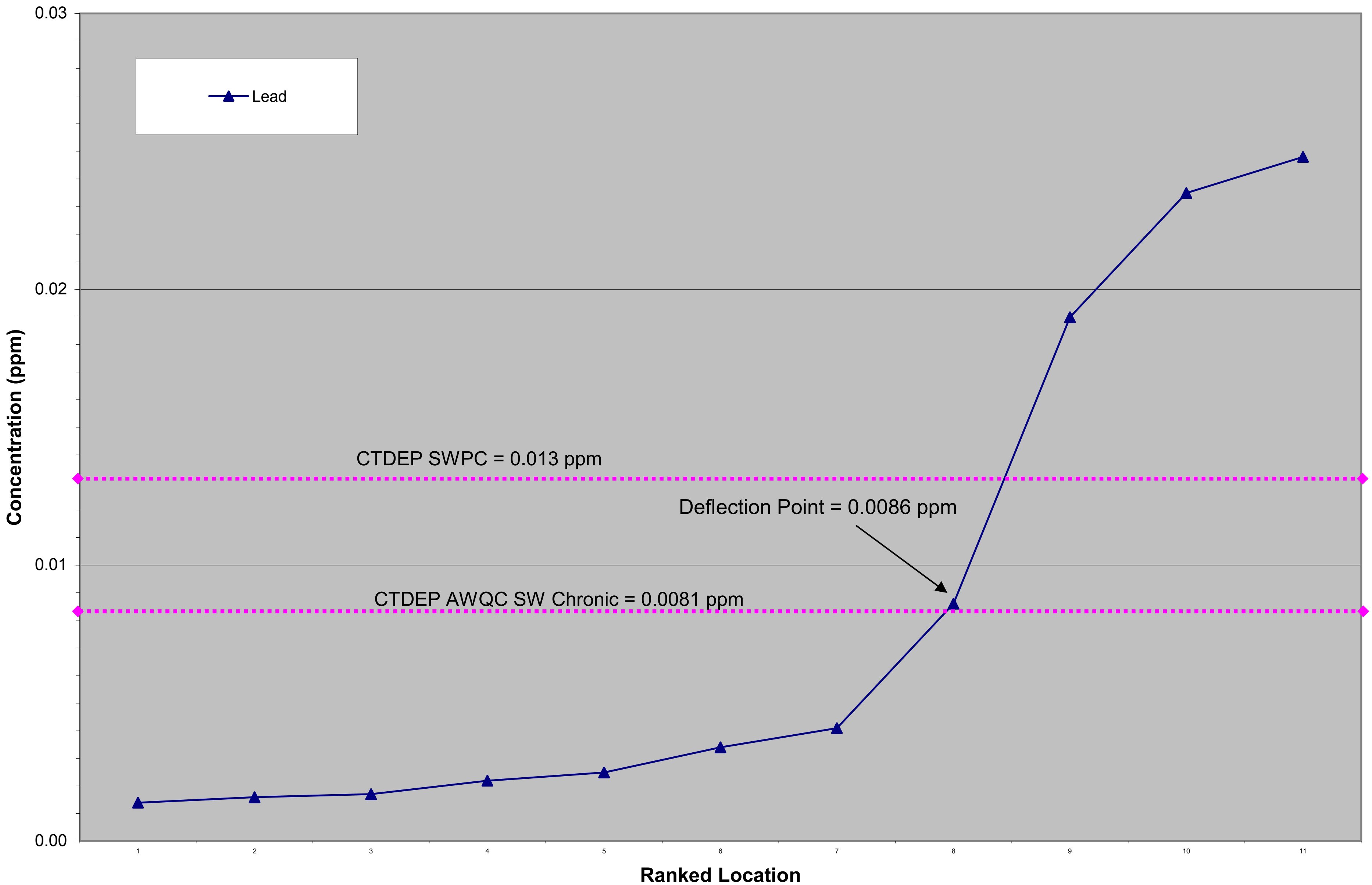


Figure N-56
Mercury Concentrations in Groundwater

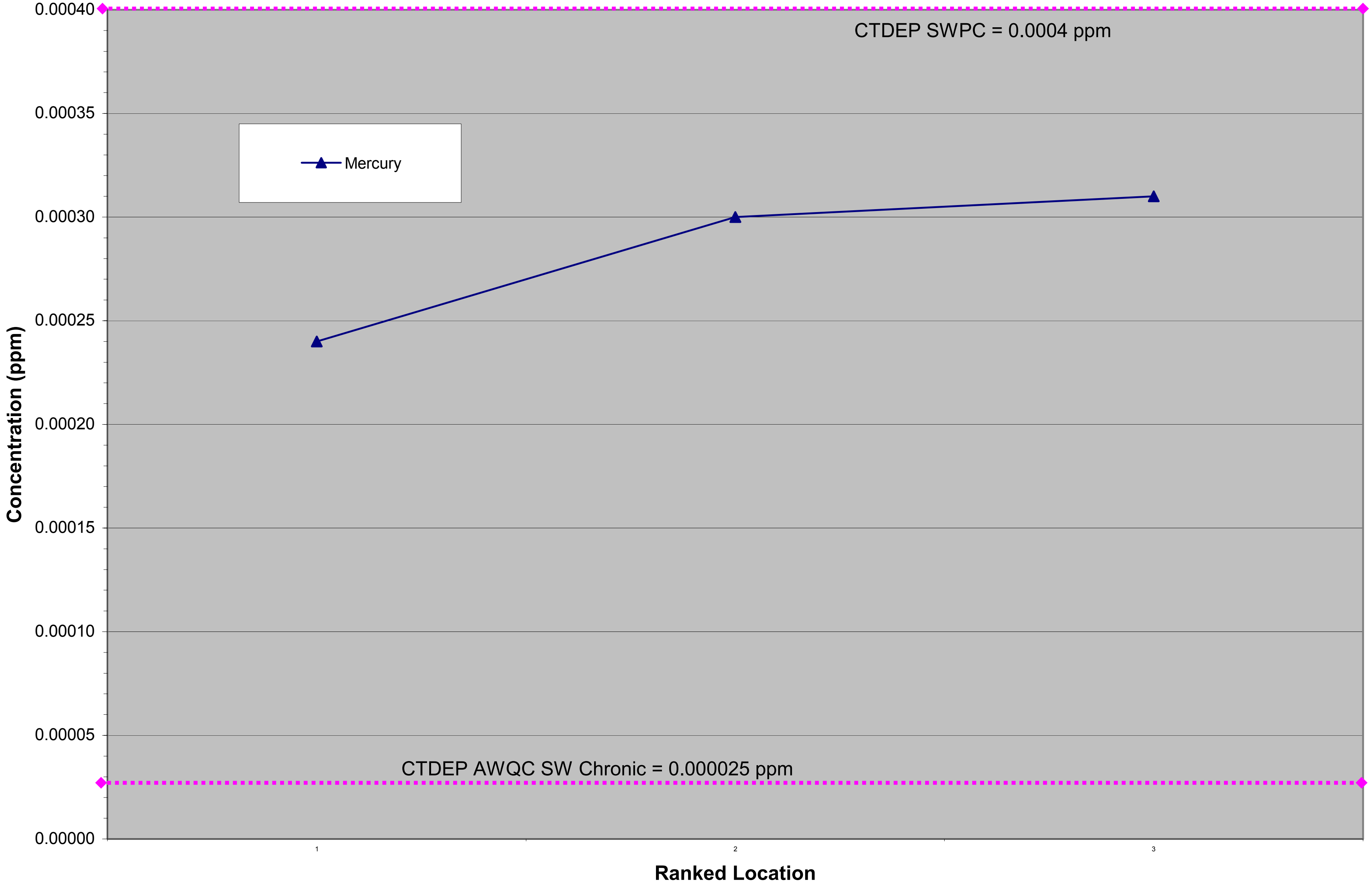


Figure N-57
Nickel Concentrations in Groundwater

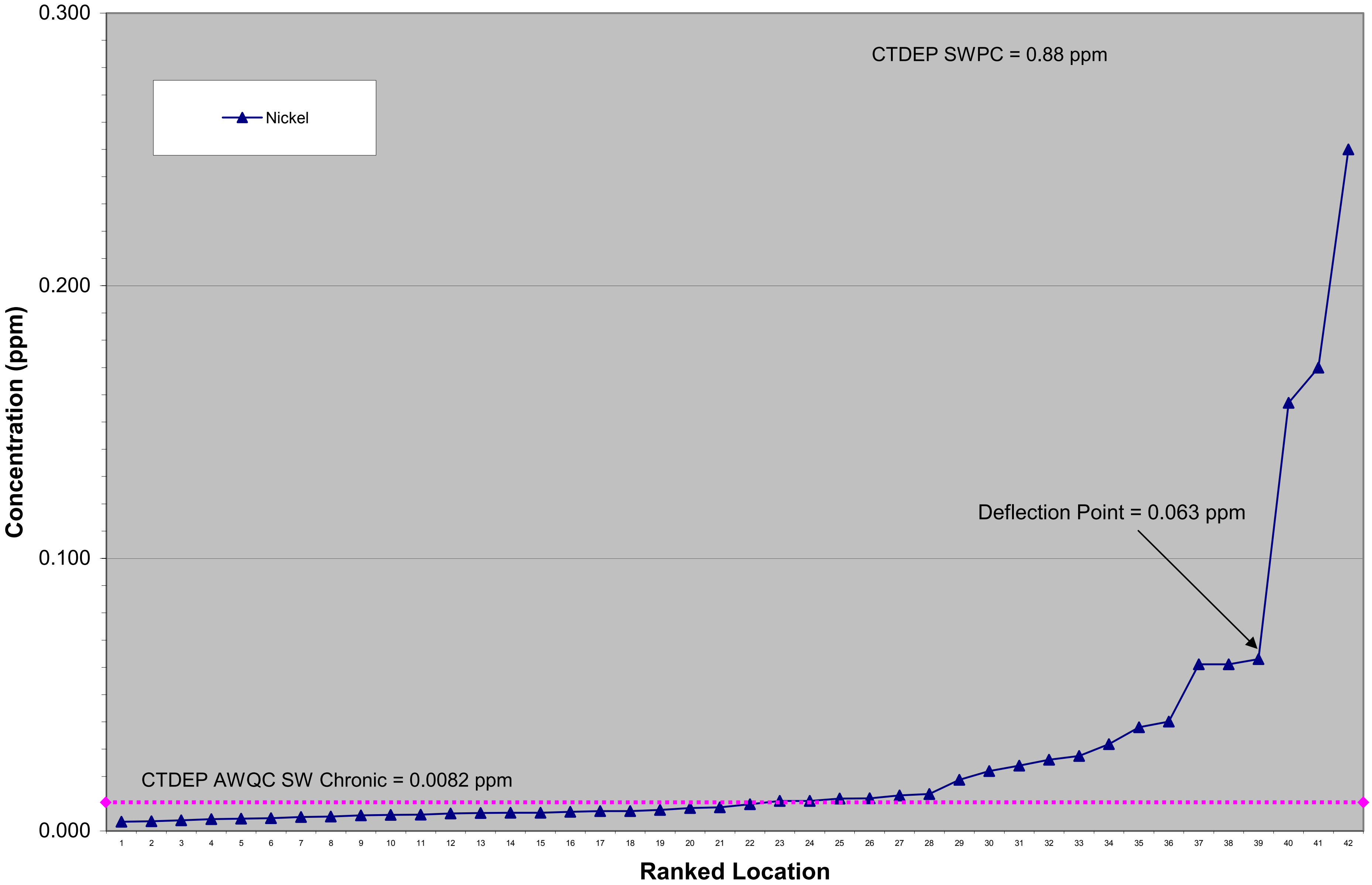


Figure N-58
Selenium Concentrations in Groundwater

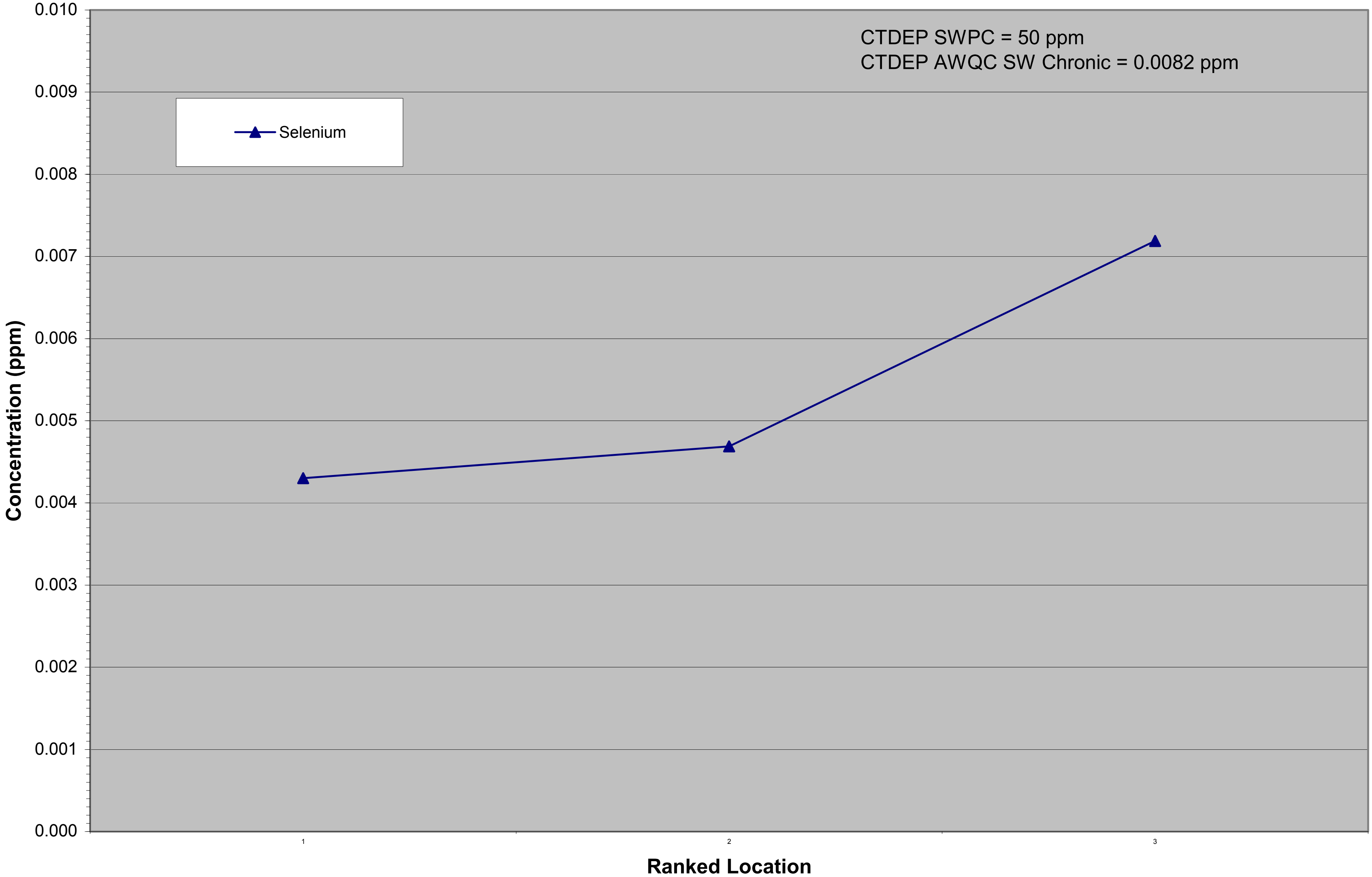


Figure N-59
Silver Concentrations in Groundwater

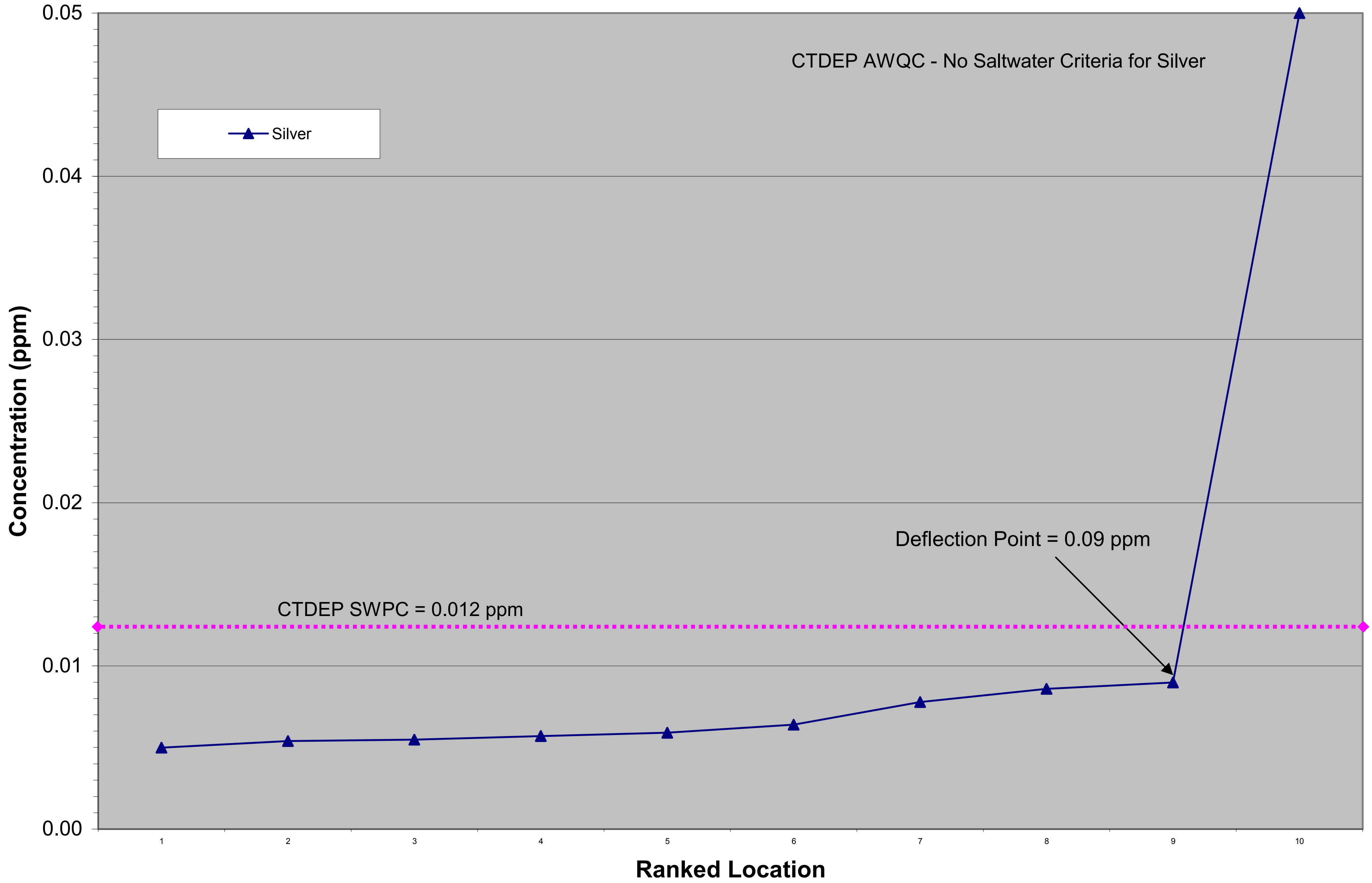


Figure N-60
Thallium Concentrations in Groundwater

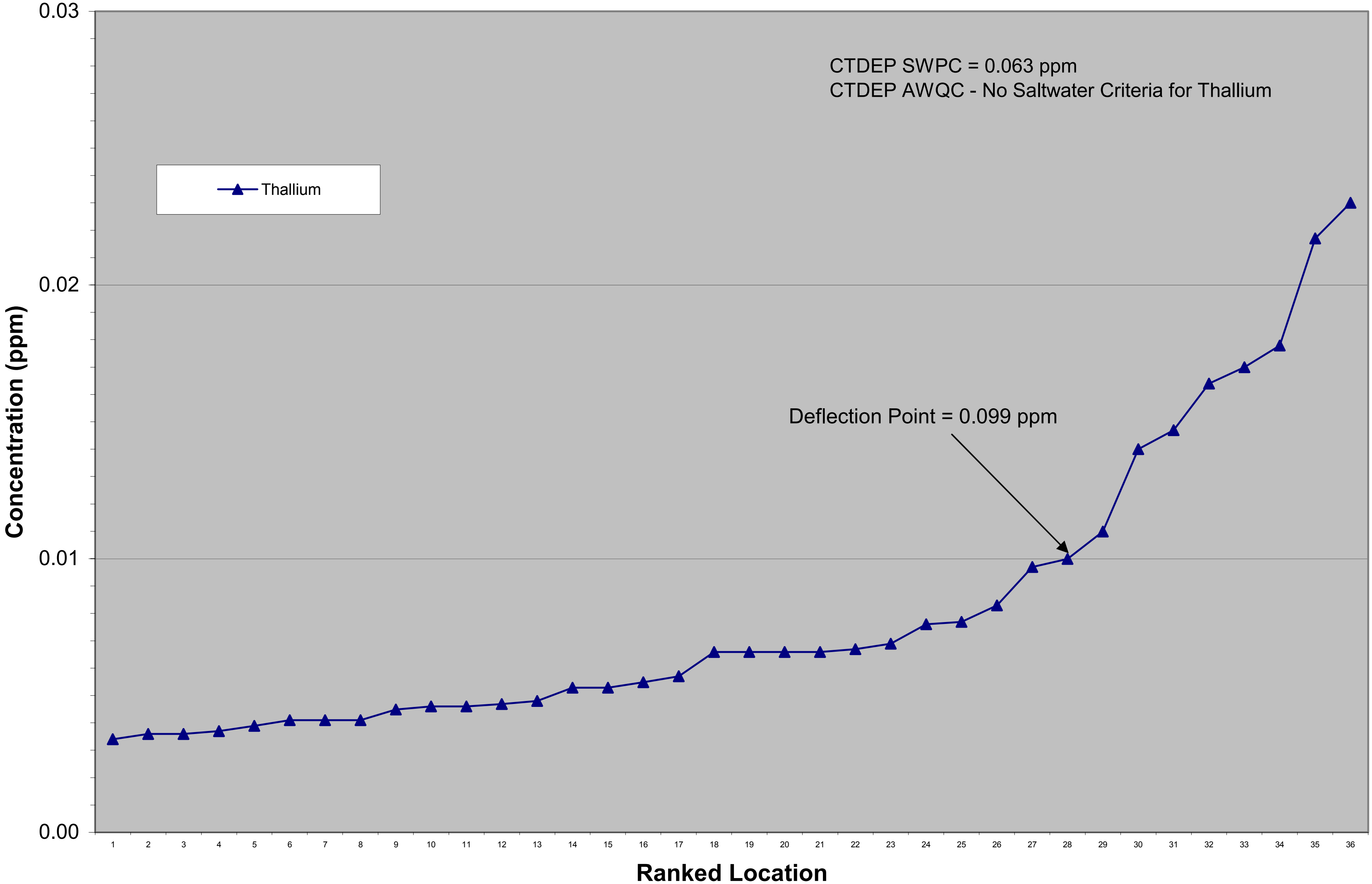


Figure N-61
Vanadium Concentrations in Groundwater

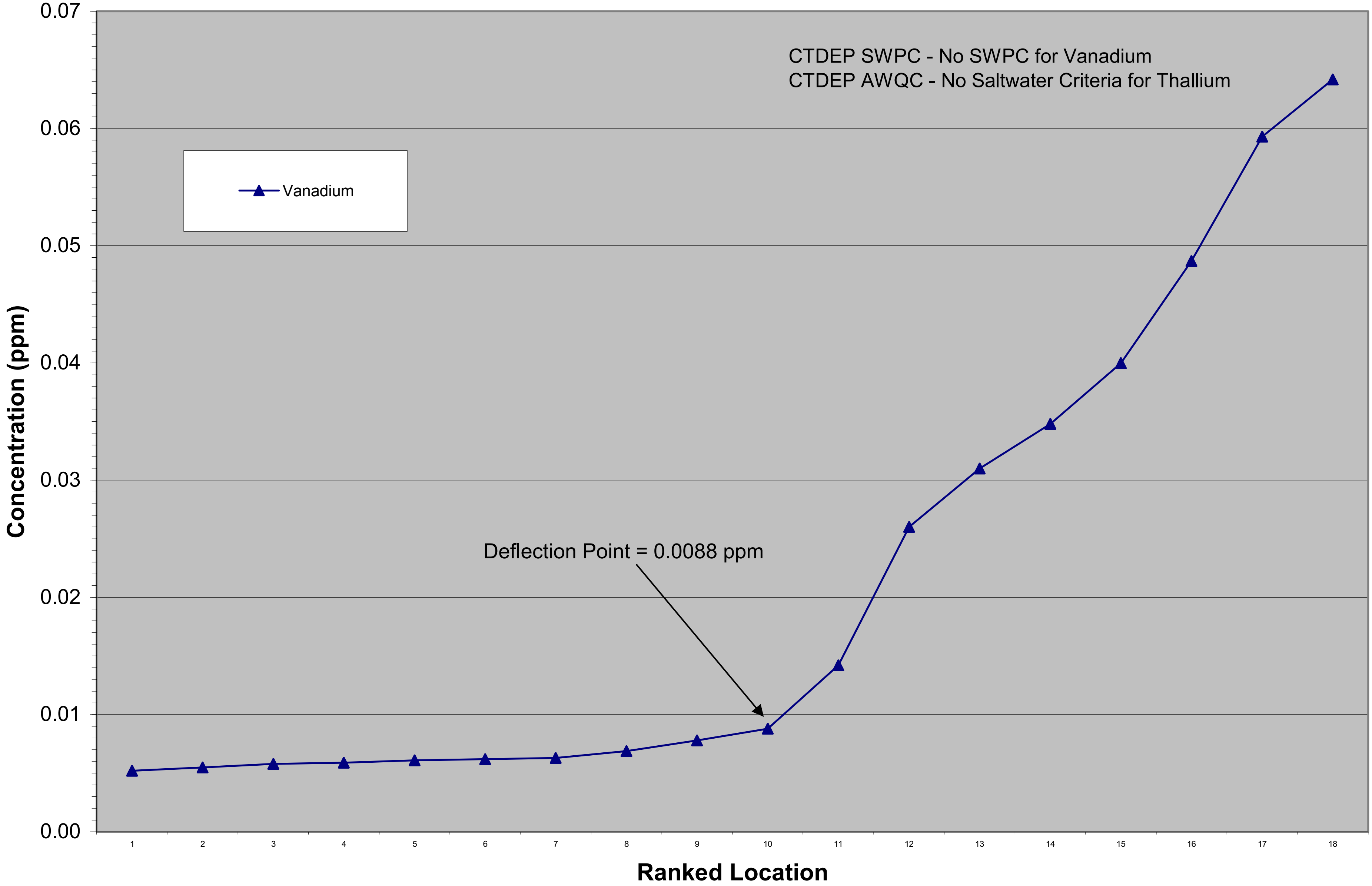


Figure N-62
Zinc Concentrations in Groundwater